

The JS 44 civil cover sheet and the information contained herein neither replace nor supplement the filing and service of pleadings or other papers as required by law, except as provided by local rules of court. This form, approved by the Judicial Conference of the United States in September 1974, is required for the use of the Clerk of Court for the purpose of initiating the civil docket sheet. (SEE INSTRUCTIONS ON PAGE TWO OF THE FORM.)

**Andreas Stihl AG & Co. KG and Stihl Incorporated**

**Bailey's Inc. and Woodland International, Inc.**

**(b) County of Residence of First Listed Plaintiff Germany**  
**(EXCEPT IN U.S. PLAINTIFF CASES)**

County of Residence of First Listed Defendant Mendicino, CA  
(IN U.S. PLAINTIFF CASES ONLY)  
NOTE: IN LAND CONDEMNATION CASES, USE THE LOCATION OF THE  
LAND INVOLVED.

**(c) Attorney's (Firm Name, Address, and Telephone Number)**

Attorneys (If Known)

Leslie M. Werlin  
McGuire Woods LLP  
1800 Century Park East, 8th Floor  
Los Angeles, California 90067

**II. BASIS OF JURISDICTION** (Place an "X" in One Box Only)

☐ 1 U.S. Government Plaintiff

☒ 3 Federal Question  
(U.S. Government Not a Party)

☐ 2 U.S. Government Defendant

☐ 4 Diversity  
(Indicate Citizenship of Parties in Item III)

**III. CITIZENSHIP OF PRINCIPAL PARTIES** (Place an "X" in One Box for Plaintiff  
(For Diversity Cases Only) and One Box for Defendant)

	PTF	DEF		PTF	DEF
Citizen of This State	<input type="checkbox"/> 1	<input type="checkbox"/> 1	Incorporated or Principal Place of Business In This State	<input type="checkbox"/> 4	<input type="checkbox"/> 4
Citizen of Another State	<input type="checkbox"/> 2	<input type="checkbox"/> 2	Incorporated and Principal Place of Business In Another State	<input type="checkbox"/> 5	<input type="checkbox"/> 5
Citizen or Subject of a Foreign Country	<input type="checkbox"/> 3	<input type="checkbox"/> 3	Foreign Nation	<input type="checkbox"/> 6	<input type="checkbox"/> 6

**IV. NATURE OF SUIT** (Place an "X" in One Box Only)

CONTRACT		TORTS		FORFEITURE/PENALTY		BANKRUPTCY		OTHER STATUTES	
<input type="checkbox"/> 110 Insurance	PERSONAL INJURY	PERSONAL INJURY	<input type="checkbox"/> 610 Agriculture	<input type="checkbox"/> 422 Appeal 28 USC 158	400 State Reapportionment				
<input type="checkbox"/> 120 Marine			<input type="checkbox"/> 620 Other Food & Drug	<input type="checkbox"/> 423 Withdrawal 28 USC 157		<input type="checkbox"/> 410 Antitrust			
<input type="checkbox"/> 130 Miller Act			<input type="checkbox"/> 625 Drug Related Seizure of Property 21 USC 881	PROPERTY RIGHTS		<input type="checkbox"/> 430 Banks and Banking			
<input type="checkbox"/> 140 Negotiable Instrument			<input type="checkbox"/> 630 Liquor Laws			<input type="checkbox"/> 450 Commerce			
<input type="checkbox"/> 150 Recovery of Overpayment & Enforcement of Judgment			<input type="checkbox"/> 640 R.R. & Truck			<input type="checkbox"/> 460 Deportation			
<input type="checkbox"/> 151 Medicare Act			<input type="checkbox"/> 650 Airline Regs.			<input type="checkbox"/> 470 Racketeer Influenced and Control Organizations			
<input type="checkbox"/> 152 Recovery of Defaulted Student Loans (Excl. Veterans)			<input type="checkbox"/> 660 Occupational Safety/Health			<input checked="" type="checkbox"/> 830 Patent	<input type="checkbox"/> 480 Consumer Credit		
<input type="checkbox"/> 153 Recovery of Overpayment of Veteran's Benefits			PERSONAL PROPERTY	<input type="checkbox"/> 840 Trademark		<input type="checkbox"/> 490 Cable/Sat TV			
<input type="checkbox"/> 160 Stockholders' Suits				LABOR		SOCIAL SECURITY	<input type="checkbox"/> 810 Selective Service		
<input type="checkbox"/> 190 Other Contract							<input type="checkbox"/> 850 Securities/Commodities/Exchange		
<input type="checkbox"/> 195 Contract Product Liability	<input type="checkbox"/> 710 Fair Labor Standards Act	<input type="checkbox"/> 875 Customer Challenge 12 USC 3410							
<input type="checkbox"/> 196 Franchise	<input type="checkbox"/> 720 Labor/Mgmt. Relations	<input type="checkbox"/> 880 Other Statutory Actions							
REAL PROPERTY	CIVIL RIGHTS	PRISONER PETITIONS	<input type="checkbox"/> 730 Labor/Mgmt.Reporting & Disclosure Act		<input type="checkbox"/> 861 HIA (1395ff)		<input type="checkbox"/> 891 Agricultural Acts		
			<input type="checkbox"/> 740 Railway Labor Act	<input type="checkbox"/> 863 DIWC/DIWW (405(g))	<input type="checkbox"/> 892 Economic Stabilization Act				
			<input type="checkbox"/> 790 Other Labor Litigation	<input type="checkbox"/> 864 SSID Title XVI	<input type="checkbox"/> 893 Environmental Matters				
			<input type="checkbox"/> 791 Empl. Ret. Inc. Security Act	<input type="checkbox"/> 865 RSI (405(g))	<input type="checkbox"/> 894 Energy Allocation Act				
			IMMIGRATION	FEDERAL TAX SUITS	<input type="checkbox"/> 870 Taxes (U.S. Plaintiff or Defendant)	<input type="checkbox"/> 895 Freedom of Information Act			
					<input type="checkbox"/> 871 IRS—Third Party 26 USC 7609	<input type="checkbox"/> 900 Appeal of Fee Determination Under Equal Access to Justice			
					<input type="checkbox"/> 462 Naturalization Application	950 Constitutionality of State Statutes			
					<input type="checkbox"/> 463 Habeas Corpus – Alien Detainee				
					<input type="checkbox"/> 465 Other Immigration Actions				
<input type="checkbox"/> 210 Land Condemnation	<input type="checkbox"/> 441 Voting	<input type="checkbox"/> 510 Motions to Vacate Sentence							
<input type="checkbox"/> 220 Foreclosure	<input type="checkbox"/> 442 Employment	<input type="checkbox"/> 530 General							
<input type="checkbox"/> 230 Rent Lease & Ejectment	<input type="checkbox"/> 443 Housing/Accommodations	<input type="checkbox"/> 535 Death Penalty							
<input type="checkbox"/> 240 Torts to Land	<input type="checkbox"/> 444 Welfare	<input type="checkbox"/> 540 Mandamus & Other							
<input type="checkbox"/> 245 Tort Product Liability	<input type="checkbox"/> 445 Amer. w/Disabilities - Employment	<input type="checkbox"/> 550 Civil Rights							
<input type="checkbox"/> 290 All Other Real Property	<input type="checkbox"/> 446 Amer. w/Disabilities – Other	<input type="checkbox"/> 555 Prison Condition							
	<input type="checkbox"/> 440 Other Civil Rights								

**V. ORIGIN** (Place an "X" in One Box Only)

☒ 1 Original Proceeding ☐ 2 Removed from State Court ☐ 3 Remanded from Appellate Court ☐ 4 Reinstated or Reopened ☐ 5 Transferred to another district (specify) ☐ 6 Multidistrict Litigation ☐ 7 Judge from Magistrate Judgment

## VI. CAUSE OF ACTION

Cite the U.S. Civil Statute under which you are filing (Do not cite jurisdictional statutes unless diversity):

35 U.S.C. 271

**Brief description of cause:**

## Patent Infringement

**VII. REQUESTED IN COMPLAINT:**

☐ CHECK IF THIS IS A CLASS ACTION UNDER F.R.C.P. 23

CHECK YES only if demanded in complaint:

**JURY DEMAND:** ☒ Yes ☐ No

**VIII. RELATED CASE(S)  
IF ANY**

PLEASE REFER TO CIVIL L.R. 3-12 CONCERNING REQUIREMENT TO FILE  
"NOTICE OF RELATED CASE".

IX. DIVISIONAL ASSIGNMENT (CIVIL L.R. 3-2)  
(PLACE AND "X" IN ONE BOX ONLY)☒ SAN FRANCISCO/OAKLAND ☐ SAN JOSE

DATE \_\_\_\_\_

1/17/08

SIGNATURE OF ATTORNEY OF RECORD

UNITED STATES DISTRICT COURT

NORTHERN District of CALIFORNIA

ANDREAS STIHL AG & CO. KG, a German  
company; and STIHL INCORPORATED, a Delaware  
corporation,

V.

BAILEY'S INC., a California corporation; and  
WOODLAND INTERNATIONAL, INC., a California  
corporation

SUMMONS IN A CIVIL ACTION

CV 08

MEJ  
0362

CASE NUMBER:

TO: (Name and address of Defendant)

Woodland International, Inc.,  
a California corporation  
44650 Highway 101  
Laytonville, California 95454

**YOU ARE HEREBY SUMMONED** and required to serve on PLAINTIFF'S ATTORNEY (name and address)

Leslie M. Werlin  
McGuireWoods LLP  
1800 Century Park East, 8<sup>th</sup> Floor  
Los Angeles, CA 90067

an answer to the complaint which is served on you with this summons, within 20 days after service  
of this summons on you, exclusive of the day of service. If you fail to do so, judgment by default will be taken against you  
for the relief demanded in the complaint. Any answer that you serve on the parties to this action must be filed with the  
Clerk of this Court within a reasonable period of time after service.

CLERK

DATE

(By) DEPUTY CLERK

ANNA SPRINKLES

JAN 18 2008

AO 440 (Rev. 8/01) Summons in a Civil Action

**RETURN OF SERVICE**Service of the Summons and complaint was made by me<sup>(1)</sup> DATE

NAME OF SERVER (PRINT)

TITLE

*Check one box below to indicate appropriate method of service*

- ☐ Served personally upon the defendant. Place where served:
- ☐ Left copies thereof at the defendant's dwelling house or usual place of abode with a person of suitable age and discretion then residing therein.  
Name of person with whom the summons and complaint were left:
- ☐ Returned unexecuted:
- ☐ Other (specify):

**STATEMENT OF SERVICE FEES**

TRAVEL

SERVICES

TOTAL

0.00

**DECLARATION OF SERVER**

I declare under penalty of perjury under the laws of the United States of America that the foregoing information contained in the Return of Service and Statement of Service Fees is true and correct.

Executed on \_\_\_\_\_  
Date Signature of Server

\_\_\_\_\_  
Address of Server

(1) As to who may serve a summons see Rule 4 of the Federal Rules of Civil Procedure.

# UNITED STATES DISTRICT COURT

NORTHERN District of CALIFORNIA

ANDREAS STIHL AG & CO. KG, a German  
company; and STIHL INCORPORATED, a Delaware  
corporation,

## SUMMONS IN A CIVIL ACTION

V.

BAILEY'S INC., a California corporation; and  
WOODLAND INTERNATIONAL, INC., a California  
corporation

CASE NUMBER:

**CV 08**

**0362**

**MEJ**

TO: (Name and address of Defendant)

Bailey's Inc.,  
a California corporation  
44650 Highway 101  
Laytonville, California 95454

**YOU ARE HEREBY SUMMONED** and required to serve on PLAINTIFF'S ATTORNEY (name and address)

Leslie M. Werlin  
McGuireWoods LLP  
1800 Century Park East, 8<sup>th</sup> Floor  
Los Angeles, CA 90067

an answer to the complaint which is served on you with this summons, within 20 days after service of this summons on you, exclusive of the day of service. If you fail to do so, judgment by default will be taken against you for the relief demanded in the complaint. Any answer that you serve on the parties to this action must be filed with the Clerk of this Court within a reasonable period of time after service.

**RICHARD M. WERLING**

CLERK

DATE

(By) DEPUTY CLERK

**ANNA SPRINKLES**

**JAN 18 2008**

AO 440 (Rev. 8/01) Summons in a Civil Action

**RETURN OF SERVICE**

Service of the Summons and complaint was made by me <sup>(1)</sup>	DATE
NAME OF SERVER ( <i>PRINT</i> )	TITLE

*Check one box below to indicate appropriate method of service*

- ☐ Served personally upon the defendant. Place where served:
- ☐ Left copies thereof at the defendant's dwelling house or usual place of abode with a person of suitable age and discretion then residing therein.  
Name of person with whom the summons and complaint were left:
- ☐ Returned unexecuted:
- ☐ Other (specify):

**STATEMENT OF SERVICE FEES**

TRAVEL	SERVICES	TOTAL
		0.00

**DECLARATION OF SERVER**

I declare under penalty of perjury under the laws of the United States of America that the foregoing information contained in the Return of Service and Statement of Service Fees is true and correct.

Executed on \_\_\_\_\_  
Date Signature of Server

\_\_\_\_\_  
Address of Server

(1) As to who may serve a summons see Rule 4 of the Federal Rules of Civil Procedure.

1 MCGUIREWOODS LLP  
2 Leslie M. Werlin #67994  
3 1800 Century Park East, 8<sup>th</sup> Floor  
4 Los Angeles, California 90067  
5 Telephone: (310) 315-8200  
6 Facsimile: (310) 315-8210  
7 lwerlin@mcguirewoods.com

8 Attorneys for Andreas Stihl AG & Co. KG and Stihl Incorporated

9 UNITED STATES DISTRICT COURT  
10 NORTHERN DISTRICT OF CALIFORNIA

11 **CV 08**

12 **0362**

MEJ

13 ANDREAS STIHL AG & CO. KG, a German  
14 company; and STIHL INCORPORATED, a  
15 Delaware corporation,

CASE NO.

COMPLAINT

16 Plaintiffs,

JURY TRIAL DEMANDED

17 vs.

18 BAILEY'S INC., a California corporation; and  
19 WOODLAND INTERNATIONAL, INC., a  
20 California corporation,

21 Defendant.

22 Plaintiffs, Andreas Stihl AG & Co. KG ("Andreas Stihl") and Stihl Incorporated ("Stihl"),  
23 for their complaint against defendants, Bailey's Inc. ("Bailey's") and Woodland International, Inc.  
24 ("Woodland") (collectively, "Defendants"), seeking damages, injunctive relief and other relief for  
25 patent infringement, allege as follows:

26 **NATURE OF ACTION**

27 1. This is an action for patent infringement arising under the Title 35 of the United  
28 States Code seeking monetary damages and injunctive relief against Bailey's and Woodland due  
to their continued violation of Plaintiffs' rights in U.S. Patent Nos. 6,079,582 and 5,320,240.

**PARTIES**

2. Andreas Stihl AG & Co. KG is a privately-held company organized and existing under the laws of the Federal Republic of Germany, with its principal place of business at Badstrasse 115, 71336 Waiblingen, Federal Republic of Germany.

3. Stihl Incorporated is a corporation organized and existing under the laws of the State of Delaware, with its principal place of business at Oceana West Industrial Park, 536 Viking Drive, Virginia Beach, Virginia 23452. Stihl Incorporated is the sole importer into the United States of products manufactured by Andreas Stihl AG & Co. KG and has been assigned the right to enforce Andreas Stihl AG & Co. KG's patents in the United States.

4. On information and belief, Bailey's is a corporation organized and existing under the laws of the State of California, having a principal place of business located at 44650 Highway 101, Laytonville, California 95454.

5. On information and belief, Woodland is a corporation organized and existing under the laws of the State of California, having a place of business located in Laytonville, California 95454.

**JURISDICTION AND VENUE**

6. Andreas Stihl's and Stihl's cause of action for patent infringement arises under the patent laws of the United States, Title 35, United States Code, including, without limitation, section 271 entitled, "Infringement of Patent."

7. This Court has jurisdiction over the subject matter of this action pursuant to 28 U.S.C. §§ 1331 and 1338(a).

8. Venue in this district is proper pursuant to 28 U.S.C §§ 1391(b) and (c) and 1400(b).

**PATENTS-IN-SUIT**

9. On January 23, 1997, a patent application entitled "Tank Closure for the Fill Opening of a Fuel Tank" was filed with the United States Patent and Trademark Office, which application resulted in the granting of United States Patent No. 6,079,582, which issued on June 27, 2000 and which is assigned on its face to Andreas Stihl AG & Co. KG (the "Nickel Patent").

10. Andreas Stihl AG & Co. KG now holds all right, title and interest in the Nickel Patent, and has assigned to Stihl Incorporated the right to enforce the patent in the United States.

11. The Nickel Patent was duly and legally issued and is still in full force and effect. A true and accurate copy of the Nickel Patent, which is valid and subsisting, is attached hereto as Exhibit A.

12. On February 1, 1993, a patent application entitled "Closure for a Vessel" was filed with the United States Patent and Trademark Office, which application resulted in the granting of United States Patent No. 5,320,240, which issued on June 14, 1994 and which is assigned on its face to Andreas Stihl AG & Co. KG (the "Wehle Patent").

13. Andreas Stihl AG & Co. KG now holds all right, title and interest in the Wehle Patent, and has assigned to Stihl Incorporated the right to enforce the patent in the United States.

14. The Wehle Patent was duly and legally issued and is still in full force and effect. A true and accurate copy of the Wehle Patent, which is valid and subsisting, is attached hereto as Exhibit B.

## COUNT I

### INFRINGEMENT OF

### U.S. PATENT NO. 6,079,582

15. Andreas Stihl and Stihl hereby incorporate by reference Paragraphs 1 through 14 by reference as if stated herein.

16. Defendants, without Andreas Stihl's or Stihl's authorization, in violation of 35 U.S.C. § 271, have infringed and continue to infringe the Nickel Patent by importing, using, offering to sell, and/or selling fuel and oil caps, including without limitation products that Bailey's identifies as "STIHL Fuel/Oil Cap (Flip Top Style) FCS 044 01," and "STIHL Oil Cap (Flip Top Style) FCS 024 01," which are covered by at least claim 1 of the Nickel Patent.

17. To the extent that the facts learned in discovery show that Defendants' infringement of the Nickel Patent is or has been willful, Andreas Stihl and Stihl reserve the right to request such a finding at the time of trial.

18. Defendants' conduct has caused Andreas Stihl and Stihl to be deprived of rights,



1 remunerations and lost profits which would have otherwise come to Andreas Stihl and Stihl but  
2 for the infringement, thereby entitling Andreas Stihl and Stihl to damages.

3 19. Andreas Stihl and Stihl have no adequate remedy at law, and Defendants' conduct  
4 has caused and, if not enjoined, will continue to cause irreparable damage to Andreas Stihl and  
5 Stihl.

6 20. As a result of Defendants' wrongful conduct, Andreas Stihl and Stihl are entitled to  
7 injunctive relief.

8 **COUNT II**

9 **INFRINGEMENT OF**

10 **U.S. PATENT NO. 5,320,240**

11 21. Andreas Stihl and Stihl hereby incorporate by reference Paragraphs 1 through 20  
12 by reference as if stated herein.

13 22. Defendants, without Andreas Stihl's and Stihl's authorization, in violation of 35  
14 U.S.C. § 271, have infringed and continue to infringe the Wehle Patent by importing, using,  
15 offering to sell, and/or selling fuel and oil caps, including without limitation products that Bailey's  
16 identifies as "STIHL Fuel/Oil Cap (Flip Top Style) FCS 044 01," and "STIHL Oil Cap (Flip Top  
17 Style) FCS 024 01," which are covered by at least claim 1 of the Wehle Patent.

18 23. To the extent that the facts learned in discovery show that Defendants'  
19 infringement of the Wehle Patent is or has been willful, Andreas Stihl and Stihl reserve the right to  
20 request such a finding at the time of trial.

21 24. Defendants' conduct has caused Andreas Stihl and Stihl to be deprived of rights,  
22 remunerations and lost profits which would have otherwise come to Andreas Stihl and Stihl but  
23 for the infringement, thereby entitling Andreas Stihl and Stihl to damages.

24 25. Andreas Stihl and Stihl have no adequate remedy at law, and Defendants' conduct  
25 has caused and, if not enjoined, will continue to cause irreparable damage to Andreas Stihl and  
26 Stihl.

27 26. As a result of Defendants' wrongful conduct, Andreas Stihl and Stihl are entitled to  
28 injunctive relief.

**RELIEF REQUESTED**

WHEREFORE, Andreas Stihl and Stihl pray:

A. That this Court order, adjudge and decree that Defendants have infringed claims of both the Nickel and Wehle Patents in violation of 35 U.S.C. § 271.

B. That injunctions, preliminary and permanent, be issued out of this Court restraining Defendants, and their officers, agents, servants and employees, from directly or indirectly making or causing to be made, selling, or causing to be sold, or offering for sale, importing, or using or causing to be used in any way the inventions of the claims of the Nickel and Wehle patents, or otherwise directly infringing, contributorily infringing or inducing infringement of the Nickel and Wehle Patents.

C. That this Court order Defendants, their officers, agents, servants and employees to deliver up to this Court for destruction all products infringing upon, directly or otherwise, any claim of the Nickel and Wehle Patents or the use of which would infringe, directly or otherwise, any claim of the Nickel and Wehle Patents.

D. That this Court order Defendants to pay the costs of this action.

E. That Defendants be ordered to account for and pay over all proceeds and profits made by it from its wrongful infringing acts, and to account for and pay to Andreas Stihl and Stihl damages in a sum to be determined by the Court.

F. That, if the evidence warrants, the damages awarded by the Court to Andreas Stihl and Stihl be trebled in view of intentional copying of Andreas Stihl's patented inventions and willful and wanton violation of Andreas Stihl's and Stihl's patent rights.

G. That, if the evidence warrants, this Court find this to be an exceptional case under 35 U.S.C. § 285 and order Defendants to pay to Andreas Stihl and Stihl reasonable attorney's fees and all other costs which may be incurred by Andreas Stihl and Stihl.

H. That this Court grant to Andreas Stihl and Stihl such other and further relief as may be deemed just and equitable.

///

///

**JURY DEMAND**

Andreas Stihl and Stihl hereby demand trial by jury on all issues so triable.

Respectfully submitted,

MCGUIRE WOODS LLP

By: 

Leslie M. Werlin

Attorneys for Andreas Stihl AG & Co. KG and  
Stihl Incorporated

**EXHIBIT A**



US006079582A

**United States Patent** [19][11] **Patent Number:** **6,079,582****Nickel et al.**[45] **Date of Patent:** **Jun. 27, 2000**[54] **TANK CLOSURE FOR THE FILL OPENING OF A FUEL TANK**

4,705,190 11/1987 Mizusawa .

**FOREIGN PATENT DOCUMENTS**[75] Inventors: **Hans Nickel**, Cottenweiler; **Harald Schliemann**, Waiblingen, both of Germany

594784	3/1960	Canada	220/238
0027970	5/1981	European Pat. Off.	
940230	12/1948	France	220/238
1039095	10/1953	France	
1142325	9/1957	France	
517386	1/1929	Germany	220/238
2045032	3/1972	Germany	
6409983	3/1966	Netherlands	220/238
1201342	8/1970	United Kingdom	

[73] Assignee: **Andreas Stihl AG & Co.**, Germany[21] Appl. No.: **08/787,628**[22] Filed: **Jan. 23, 1997**[30] **Foreign Application Priority Data**

Jan. 23, 1996 [DE] Germany ..... 196 02 253

[51] **Int. Cl.<sup>7</sup>** ..... **B65D 53/00**[52] **U.S. Cl.** ..... **220/238; 220/234; 220/375; 220/DIG. 33**[58] **Field of Search** ..... **220/234, 238, 220/375, DIG. 33; 215/359**[56] **References Cited****U.S. PATENT DOCUMENTS**

2,043,412	6/1936	Klein	220/238 X
2,092,182	9/1937	Ray	220/238
2,604,225	7/1952	Armstrong	220/238
2,952,526	9/1960	Carlson et al.	220/328 X
3,035,734	5/1962	De Pew	220/238
3,335,895	8/1967	Santarelli	220/238
4,113,138	9/1978	Fields et al.	

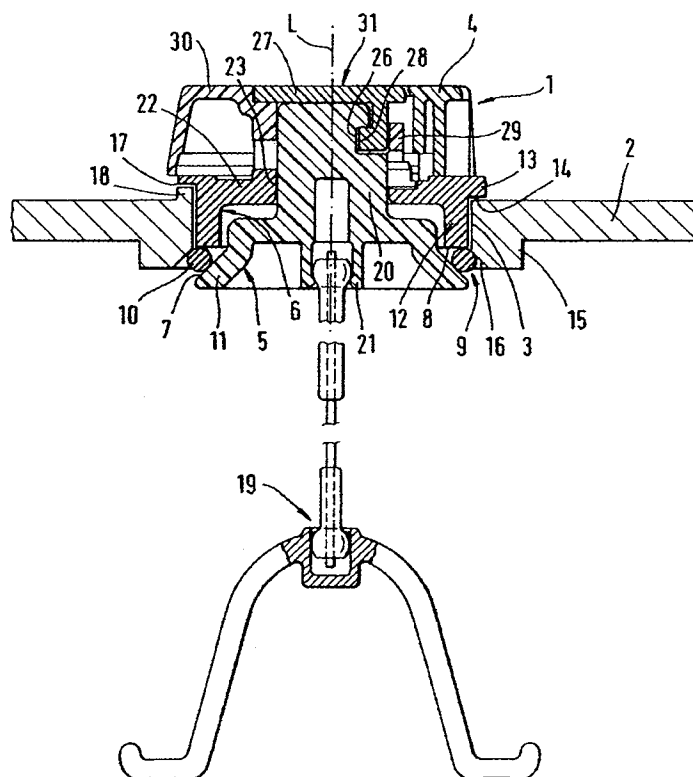
Primary Examiner—Stephen K. Cronin

Attorney, Agent, or Firm—Robert W. Becker &amp; Associates

[57]

**ABSTRACT**

A tank closure for a fill opening of a fuel tank has a closing device extending axially through the fill opening of the fuel tank. The closing device includes a grip for actuating the closing device. The closing device also includes a first clamping member and a second clamping member movable axially toward one another. The first clamping member has a first clamping surface and the second clamping member has a second clamping surface. The first and second clamping surfaces face one another and define therebetween an annular chamber. The first and second clamping surfaces are positioned at an angle  $\alpha$  to one another. The closing device also includes a radially elastically expandable sealing ring positioned in the annular chamber.

**32 Claims, 8 Drawing Sheets**

## U.S. Patent

**Jun. 27, 2000**

Sheet 1 of 8

**6,079,582**

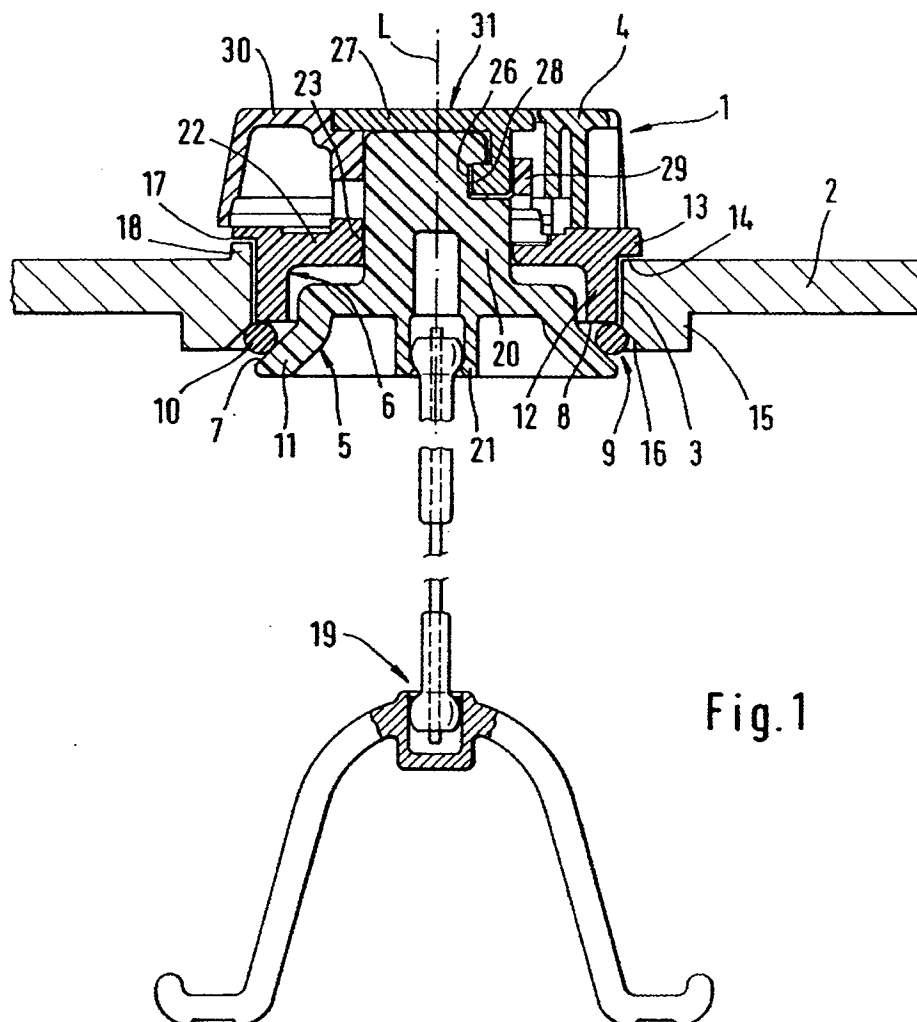


Fig. 1

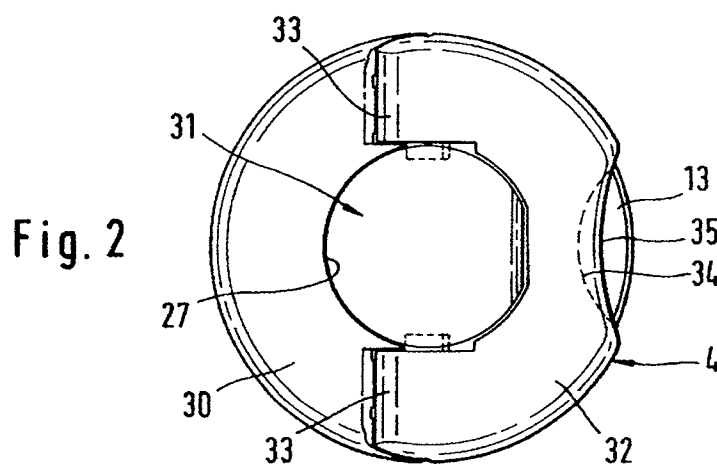


Fig. 2

U.S. Patent

Jun. 27, 2000

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6,079,582

Fig. 3

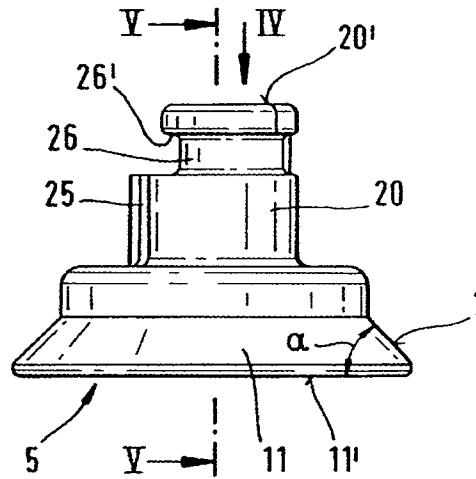


Fig. 4

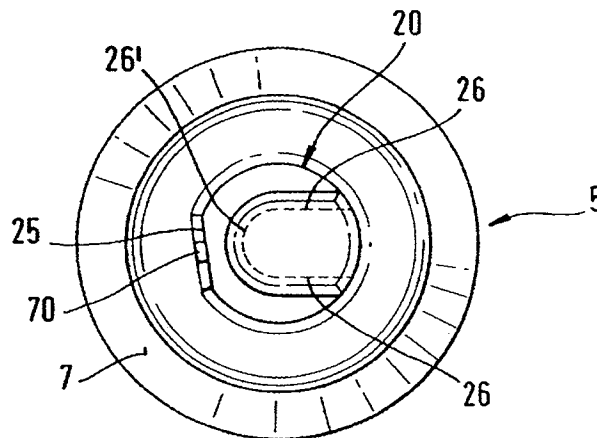
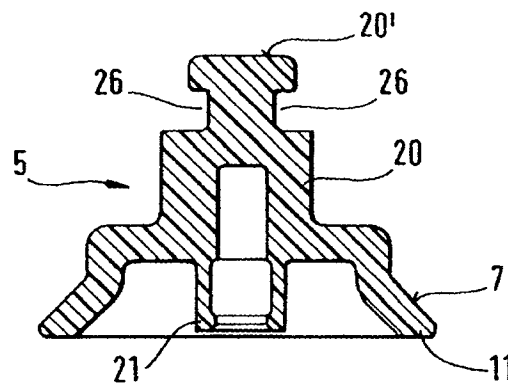


Fig. 5



U.S. Patent

Jun. 27, 2000

Sheet 3 of 8

6,079,582

Fig. 6

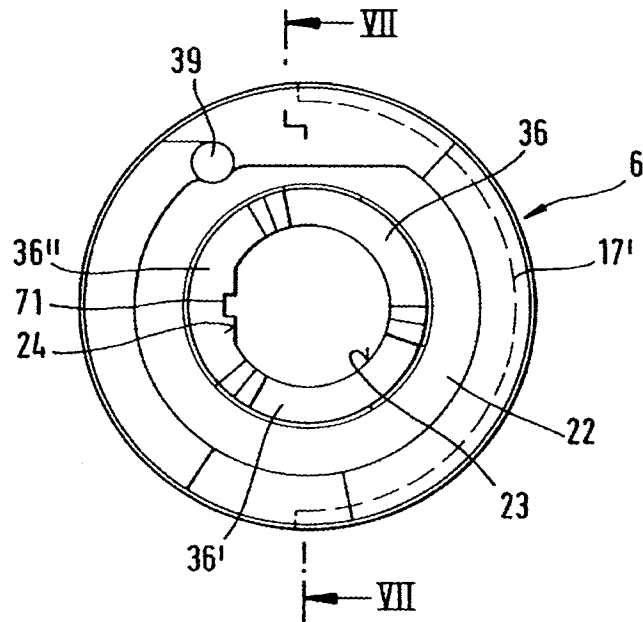


Fig. 7

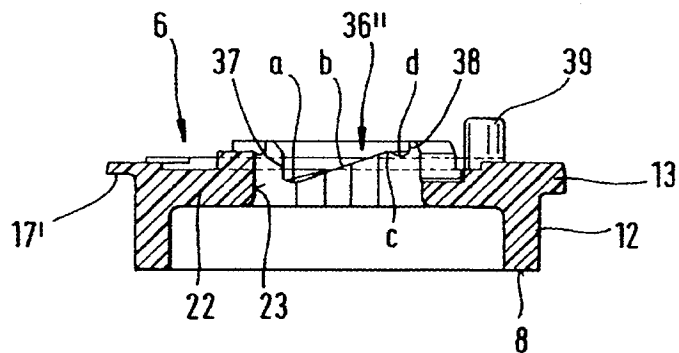


Fig. 8





U.S. Patent

Jun. 27, 2000

Sheet 4 of 8

6,079,582

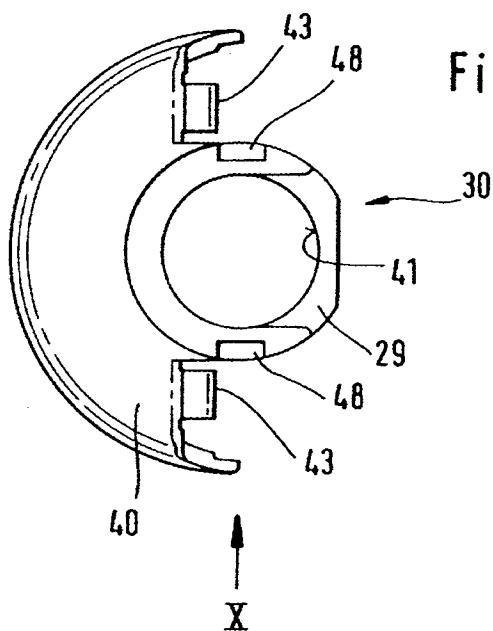


Fig. 9

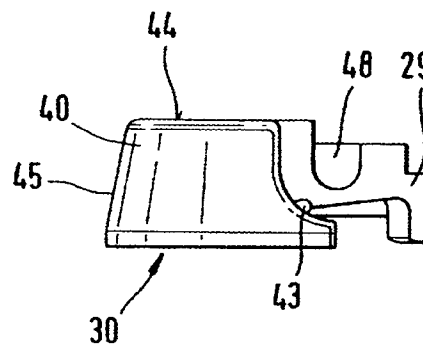


Fig. 10

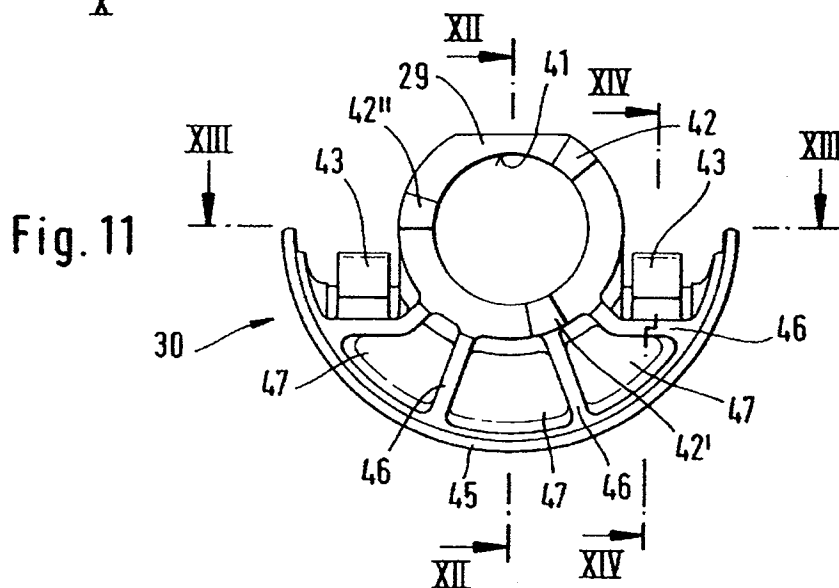


Fig. 11

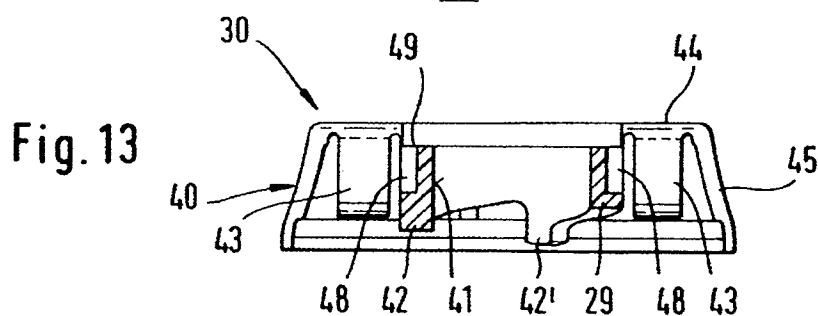


Fig. 13

U.S. Patent

Jun. 27, 2000

Sheet 5 of 8

6,079,582

Fig. 12

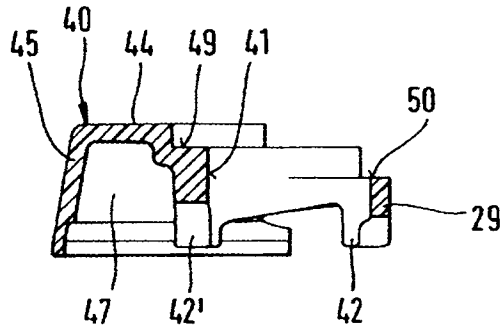


Fig. 14

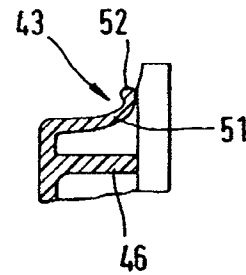


Fig. 19

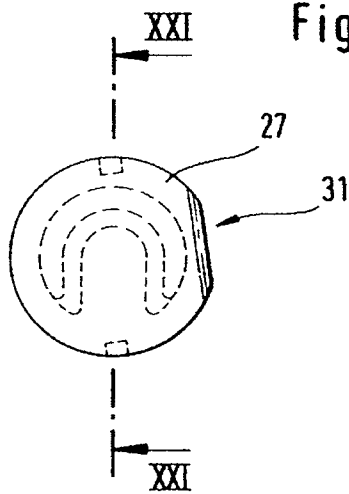


Fig. 20

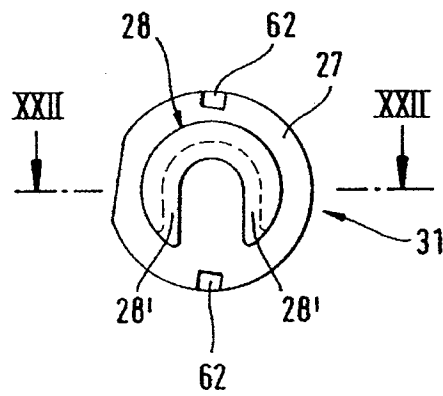


Fig. 21

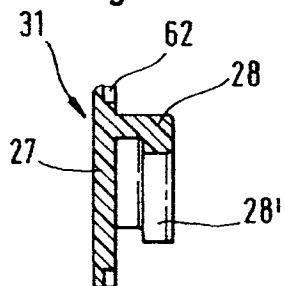
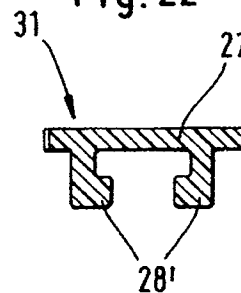


Fig. 22



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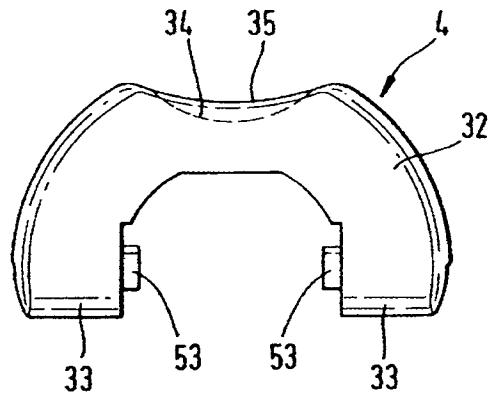


Fig. 15

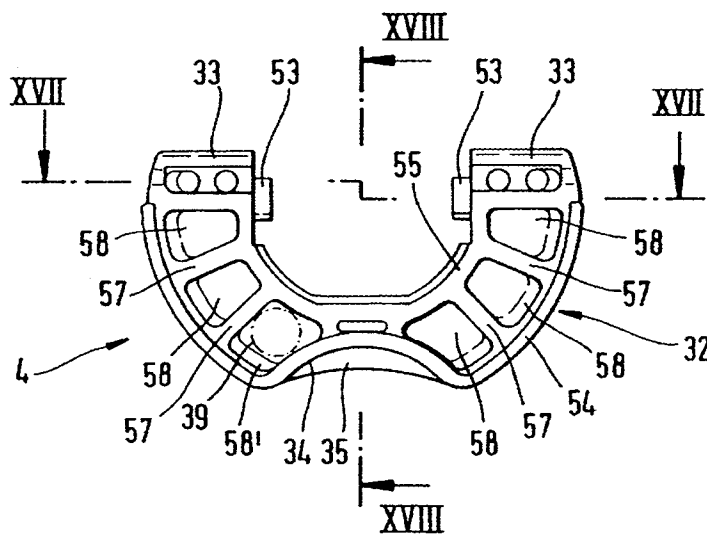


Fig. 16

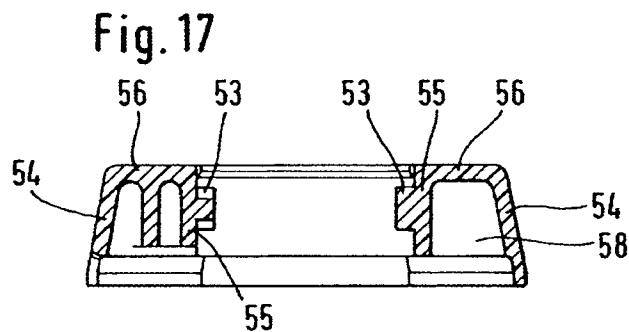


Fig. 17

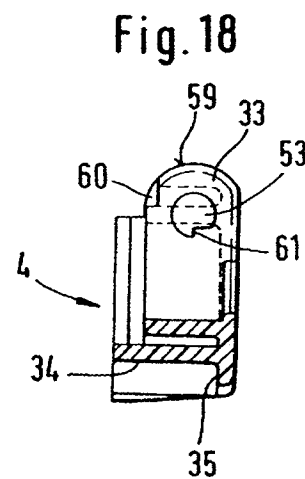


Fig. 18

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Fig. 23

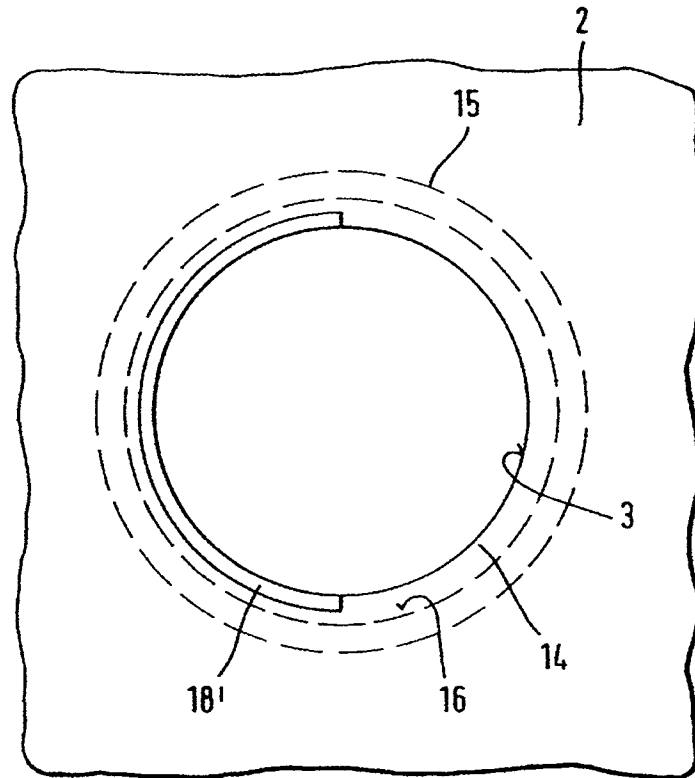
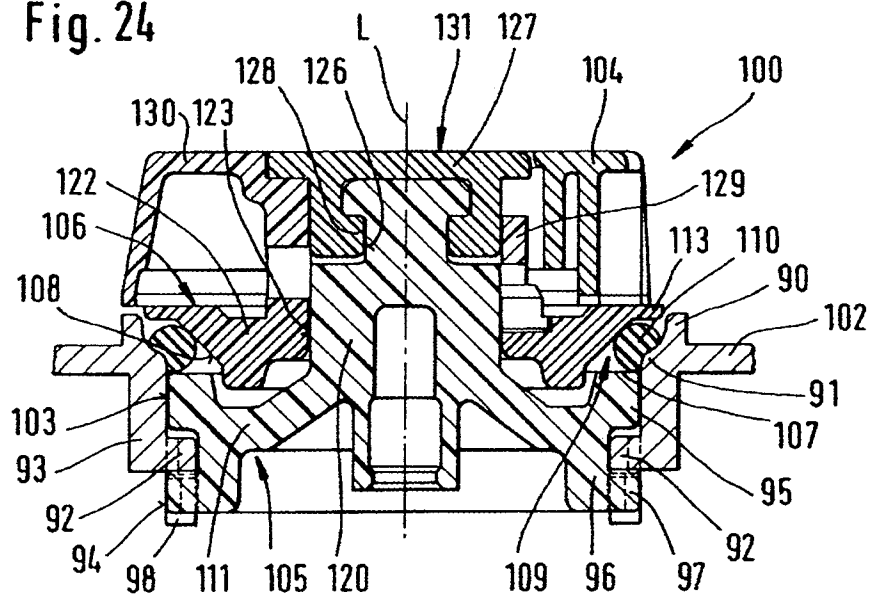


Fig. 24



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Fig. 25

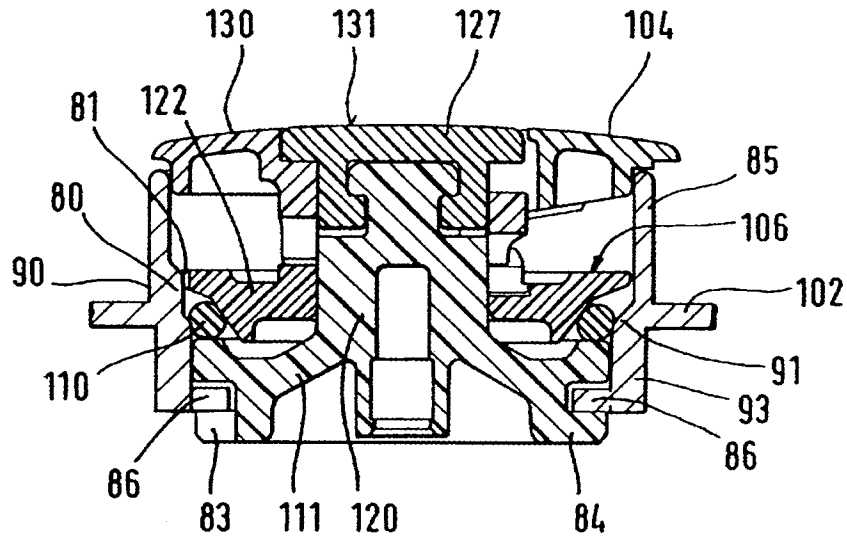
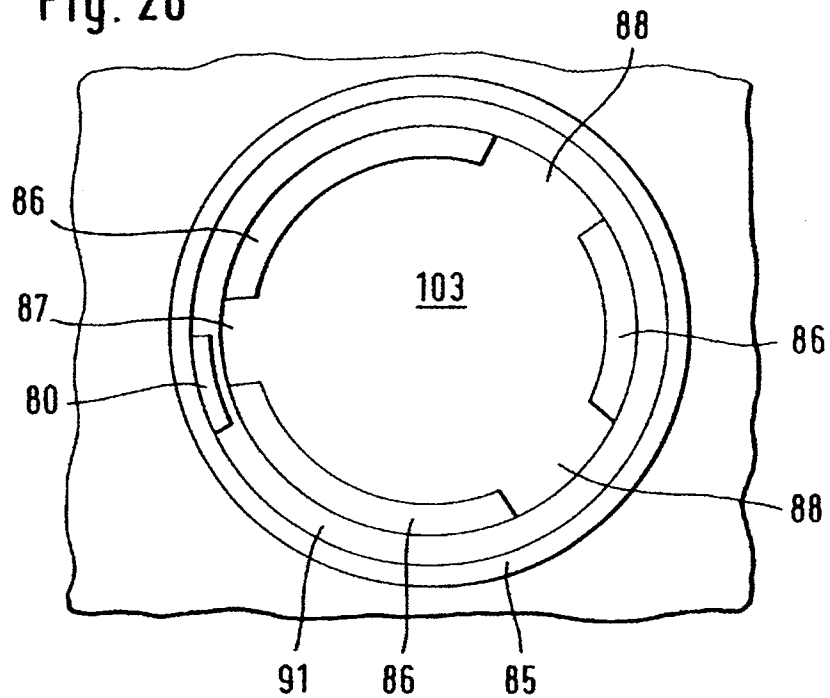


Fig. 26



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## TANK CLOSURE FOR THE FILL OPENING OF A FUEL TANK

### BACKGROUND OF THE INVENTION

The present invention relates to a tank closure for the fill opening of a fuel tank, especially for a fuel tank of a portable working tool with an internal combustion engine, the tank closure comprising a closure device penetrating the fill opening and a grip portion for actuating the closure device.

In U.S. Pat. No. 4,113,138 a tank for liquids with a tank closure is disclosed. The tank comprises a fill socket which is provided with an exterior thread. The tank closure is comprised of a substantially cup-shaped component with an interior thread so that the tank closure can be threaded onto the fill socket. The tank closure at its inner side is provided with a sealing comprised of an elastic material whereby the exterior edge of this sealing is clamped between an annular bottom surface of the tank closure and an upper annular surface of the fill socket.

Such a tank closure arrangement requires considerable constructive space in order to allow the arrangement of the corresponding threads required for threading. Corresponding to the number of thread windings the tank closure must be turned a corresponding number of times in order to be threaded onto the fill socket so that finally the sealing is clamped between the respective surfaces and the sealing action is achieved. Such a fill socket with screwed-on tank closure projects substantially past the actual contour of the fuel tank so that such an arrangement is not suitable for small fuel tanks with smooth contours. This is especially true for portable working tools such as, for example, motor chainsaws, trimmers, cutting devices etc. the manipulation of which would be impaired with such projecting fill sockets and tank closures being present.

From U.S. Pat. No. 4,705,190 it is known to arrange a tank closure in a recessed manner so that the tank closure does not project past the outer contour. However, the tank closure in this design is positioned in a recess within the vehicle body whereby between the tank and the tank closure an elongate filling pipe is provided. At the upper end of the filling pipe an inner thread is provided into which the pin-shaped section of the tank closure with external thread is to be threaded. Such an arrangement is also entirely unsuitable for fuel tanks of portable working tools because an elongate filling pipe and also the arrangement of a thread with multiple thread windings for threading the tank closure requires too much space and is detrimental to manipulating the working tool.

It is therefore an object of the present invention to provide a tank closure of the aforementioned kind which is simply insertable into the fill opening of a fuel tank having preferably a substantially smooth contour and which closes off the fuel tank in a reliable manner.

### SUMMARY OF THE INVENTION

The tank closure for a fill opening of a fuel tank according to the present invention is primarily characterized by:

A closing device extending axially through the fill opening of a fuel tank;

The closing device comprising a grip for actuating the closing device;

The closing device comprising a first clamping member and a second clamping member;

The first and second clamping members movable axially toward one another;

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The first clamping member having a first clamping surface and a second clamping member having a second clamping surface;

The first and second clamping surfaces facing one another and defining therebetween an annular chamber;

The first and second clamping surfaces positioned at an angle  $\alpha$  to one another; and

The closing device further comprising a radially elastically expandable sealing ring positioned in the annular chamber.

Advantageously, the first clamping member is a disk having a frusto-conical mantle surface and the frusto-conical mantle surface is the first clamping surface.

The second clamping member preferably comprises a ring positioned coaxially to the disk. The ring has an end face and the end face is the second clamping surface.

The second clamping surface extends at a right angle to a longitudinal axis of the closing device.

The disk preferably has a pin. The ring comprises a unitary disk member having an opening. The pin has a cross-section matching the contour of the opening. The pin is received in the opening so that the disk member is axially movably guided by the pin.

The cross-section and the contour have a circular-arc portion connected by a straight portion. One of the straight portions has a projection extending parallel to the longitudinal axis of the closing device. The other straight portion has a groove extending parallel to the longitudinal axis of the closing device.

Advantageously, the disk has a first outer diameter and the ring has a second outer diameter, wherein the first and second outer diameters have minimal play relative to the diameter of the fill opening so as to allow removal of the closing device from the fill opening.

The ring preferably comprises flange remote from the annular chamber and the flange rests at the peripheral edge of the fill opening.

The flange has preferably arc-shaped recess extending over an angular distance of up to 180°. The fill opening has an annular segment connected to the peripheral edge for engaging the arc-shaped recess. The annular segment extends over an annular distance identical to the angular distance of the arc-shaped recess.

The first clamping member is advantageously a first disk. The first disk comprises at least one first axial section having an upper end face. The upper end face is the first clamping surface. The second clamping member is a second disk and has a conical mantle surface. The conical mantle surface is the second clamping surface.

Preferably, the fill opening is an annulus formed at the fuel tank and extending into the interior of the fuel tank. The end of the annulus within the interior of the fuel tank has a radially inwardly extending step.

The fuel tank preferably has an axially outwardly projecting annular collar surrounding the fill opening. The annular collar has an inwardly curved inner wall and the inner wall has a curved transition into the inner wall of the annulus.

The inner wall of the annular collar has at least one inner radial projection and the second disk has a radial recess. The inner radial projection engages the radial recess.

The first disk preferably comprises a second axial section extending coaxially through the radially inwardly extending step and positive-lockingly secured thereat.

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Expediently, the radially inwardly extending step has at least two ring segments and recesses interposed between the ring segments. The radially inwardly extending step has cutouts at the end face thereof facing the interior of the fuel tank. The second axial section comprises outer radial projections extending into the recesses interposed between the ring segments and engaging the cutouts.

Three of the ring segments, three of the recesses, and three of the outer radial projections are preferably provided. At least one of the ring segments and one of the recesses extend over an angular distance different from the angular distance of the remaining ring segments and recesses.

The first clamping surface extends preferably at a right angle to the longitudinal axis of the closing device.

The first disk preferably has a pin and the second disk has an opening. The pin preferably has a cross-section identical to the contour of the opening. The pin is preferably received in the opening so that the second disk is axially movably guided by the pin.

The closure device may further comprise a pressure member for transmitting the actuating movement of the grip portion for actuating the tank closure into a relative axial movement of the first and second clamping members.

The fuel tank has an axially outwardly projecting annular collar surrounding the fill opening and a sleeve portion connected to the annular collar remote from the fuel tank. The sleeve portion radially surrounds the pressure member and the grip.

The first clamping member is a first disk having a pin. The pressure member is supported on the pin so as to be rotatable about the longitudinal axis of the closing device. The closing device comprises at least one control path extending as a circular arc about the longitudinal axis. The pressure member cooperates with the at least one control path.

The first clamping member is preferably a disk having a frusto-conical mantle surface and the frusto-conical mantle surface is the first clamping surface. The disk has a pin. The pressure member is supported on the pin so as to be rotatable about the longitudinal axis of the closing device. The closing device comprises at least one control path extending as a circular arc about the longitudinal axis. The pressure member cooperates with the at least one control path.

The second clamping element may comprise a ring positioned coaxially to the disk. The pressure member comprises a ring segment including a centrally arranged ring element. The ring element has an inner diameter matching the outer diameter of the pin. The ring element has at least one cam connected to the surface facing the ring. The ring includes a surface provided with the at least one control path. The at least one cam cooperates with the at least one control path.

Preferably, the tank closure includes three of the cams and three of the control paths. The three cams are spaced at an angular distance of 120° relative to one another and the three control paths are spaced at an angular distance of 120° relative to one another. The control stroke of each one of the three control paths extends preferably over an angular distance of approximately 80°.

The ring segment has an axial height greater than the axial height of the ring element and the top surface of the ring segment projects upwardly past the upper end of the pin.

The grip portion is preferably a C-shaped bracket having free ends. The free ends are pivotably connected to the pressure member. The pivoting range of the grip from the rest position into an actuating position is preferably approximately 90°.

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Each one of the free ends has a radially inwardly extending peg wherein the ring element has matching radial openings for receiving the pegs.

The tank closure preferably further comprises a securing element connected to the pin. The grip in the actuating position engages across the securing element and is rotatable together with a pressure member about the longitudinal axis of the closure device. The securing element comprises a cover plate and a U-shaped locking member connected to the cover plate so as to extend parallel to the cover plate. The U-shaped locking member comprises parallel legs. The pin has preferably tangential recesses and the parallel legs engage these tangential recesses.

The radial openings open toward the cover plate and the cover plate, in areas congruent with the radial openings, has radially extending cutouts having a width of one half a width of the radial openings.

Advantageously, the pressure member comprises elastic tongues with locking projections. The free ends of the C-shaped bracket has recesses for receiving the locking projections for securing the grip in the rest position at the pressure member. The pegs have an edge extending parallel to the axis of rotation of the grip and the edges, in the actuating position of the grip, are in abutment with the sidewall of the cutouts. Expediently, the sealing ring in a radially expanded position is pressed against the first and second clamping surfaces and against a wall surface defining the fill opening, wherein the wall surface is frusto-conical. The essential advantages of the inventive tank closure are to be seen in that there is no need for a filling socket formed at the tank so as to extend outwardly or inwardly and that the tank closure can be easily and quickly fastened by axial movement between two clamping elements to thereby reliably and sealing close off the fill opening. Due to the axial movement of the clamping members relative to one another, respectively, toward one another, the sealing ring comprised of an elastic material is radially expanded and is thus pressed against the two clamping members as well as against a wall surface of a fuel tank in a sealing manner.

According to a preferred embodiment of the tank closure, a first clamping member is in the form of a disk with a frusto-conical mantle surface that forms a surface limiting the annular chamber. The frusto-conical mantle surface is slanted so that the corresponding surface of the second clamping member delimiting the annular chamber can extend at a right angle to the longitudinal axis of the tank closure. It is thus expedient to provide the second clamping member such that it includes a ring arranged coaxially to the disk and having an end face which also forms a surface that delimits the annular chamber.

In order to achieve excellent centering of the tank closure within the fill opening and thus a uniform loading of the elastic sealing ring, it is advantageous that the outer diameter of the ring and of the disk are substantially identical relative to the diameter of the fill opening so as to be substantially free of play within the fill opening. In order for the force generated by the axial clamping of the two clamping members to be supported at the exterior of the fuel tank, it is expedient to provide the ring with a radial flange that is facing away from the annular chamber and rests at the edge of the tank surrounding the fill opening. In order for this second clamping member to be rotatably secured at the tank, it is especially advantageous to provide at the flange at least one depression to be engaged by a projection provided at the edge of the tank.

The first clamping member may be embodied as a disk having at least one axial section the upper end face of which



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forms the first clamping surface while the second clamping member is a disk having a substantially conical contour limiting the annular chamber is and forming the second clamping surface. Such an embodiment is especially useful when the sealing surface at the fill opening is not positioned at the interior of the tank but at the exterior of the tank. For this purpose it is expedient to embody the fill opening as an annulus formed at the fuel tank and the ring having a step that extends into the exterior of the fuel tank. This annulus thus allows for an exact guiding and centering of the closure device whereby the exterior end face of the annulus can serve as an abutment for the sealing ring. Preferably, the fuel tank is provided with an axial outwardly projecting annular collar which surrounds the fill opening annularly whereby the inwardly curved inner wall of the collar has a curved transition adjacent to the annulus.

This axial annular collar serves, on the one hand, as an insertion aid and, on the other hand, prevents a radial deflection of the sealing ring away from the annular chamber. In the clamped state the curved transition is pressed into the material of the rubber ring so that an increased pressing force and an increased sealing action are produced. With suitable measures at the step of the annulus forming the fill opening as well as at the second axial section of the disk, a bayonet-type closure (locking) between the closing device and the edge of the fill opening can be produced.

In order to uniformly force-load and widen the elastic sealing ring over the entire circumference of the clamping member, it is expedient to guide the two clamping members exactly axially so that a lateral deviation and thus the generation of non-uniform clamping forces can be avoided. For this purpose it is expedient to provide a pin at the disk on which a disk member formed as a unitary part of the ring is axially displaceably guided. In the same manner, the disk member of the second embodiment is guided. It is advantageous that the disk or disk member comprise an opening which corresponds to the cross-section of the pin. This allows for a coaxial guiding of the second clamping member on the pin of the first clamping member. In order to prevent rotation between the two clamping members, it is advantageous to provide the pin and the opening with a substantially circular cross-sectional shape which is provided with a chord of identical size. As an additional securing device it is possible to provide a tongue-and-groove arrangement at the pin or the opening. The tongue-and-groove arrangement extends parallel to the longitudinal axis.

In order to transform the movement of the grip for actuating the tank closure into a relative axial movement of the clamping member, it is expedient to provide a pressure member that is rotatably supported on the pin so as to be rotatable about the longitudinal axis of the closure device. Further, at least one curved path is provided which extends on a circular arc about the longitudinal axis so that the rotational movement of the grip results in an axial movement of the clamping member. The pressure member has preferably the shape of a ring segment to which is connected a centrally arranged ring element the inner diameter of which corresponds to the outer diameter of the pin. With such an arrangement of the pressure member on the pin of the first clamping member the pressure member is rotatable about the longitudinal axis of the closing device. At least one cam is arranged at the side of the ring element facing the second clamping element. The cam(s) cooperate(s) with the curved path(s) on the side of the disk facing the ring element.

For a uniform force distribution across the entire circumference and for avoiding clamping forces resulting from axial displacement of the components movable relative to

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one another, it is advantageous that respectively three cams and three curved paths are provided so as to be spaced relative to one another at an angular distance of 120° whereby the control stroke of each cam at its respective curved path extends over an angular distance of preferably approximately 80°. The axial height of the ring segment is greater than the axial height of the ring element. The upper side of the ring segment projects past the upper end of the pin. The ring segment, together with the grip and a securing element connected to the outer end of the pin, forms the outer border of the tank closure so that the upper end of the pin is completely covered. In this manner, the penetration of dirt can be avoided and the functional reliability of the parts of the tank closure moving toward one another can be ensured.

In a further preferred design the grip is mounted such that it is pivotable about an axis that is positioned at a right angle to the longitudinal axis of the fill opening. This has the advantage that even for small tank closures, due to the liftable grip, a sufficient torque can be applied for opening or closing the tank closure. After closing the tank closure, the grip is pivoted about the rotational axis extending at a right angle to the longitudinal axis of the fill opening so that the grip is placed flat onto the top part of the tank closure and thus forms together therewith a uniform continuous contour that can be slightly curved or can be planar. Thus, there is no impediment when working with the portable working tool as would be otherwise the case for projecting tank closures. Also, an accidental release of the tank closure by impacts acting in the tangential direction onto the tank closure is prevented.

The grip is expediently in the form of a substantially C-shaped bracket which is pivotably supported with its free ends at the pressure member. This type of support includes preferably the ring element being provided with two radially extending openings in which the radially inwardly oriented pegs at the free ends of the grip engage. As mentioned before, the grip portion is designed such that in its rest position it has a substantially uniform contour with the tank closure. While in the rest position the grip is thus resting flat at the tank closure in order to be able to use the tank closure, to open or close the tank, it must project from the plane of the pressure member. For this reason, it is expedient that between the two defined positions, i.e., the rest position and the actuating position, a pivot angle of approximately 90° is provided.

In its actuating position, the grip extends across the upper end of the securing element connected to the pin whereby the grip with the pressure member is rotatable about the longitudinal axis of the closure device. The securing element comprises preferably a cover plate which covers the arrangement in the outward direction as well as a U-shaped locking member with parallel legs forming a unitary part of the cover plate and extending parallel to the cover plate. The legs of the locking member engage tangential recesses of the pins so that the components, resting axially and in the circumferential direction on the pin, are secured reliably at the pin. In order for the cover plate to form a smooth exterior surface together with the pressure member, the upper side of the ring segment is provided with a cutout in which the edge of the cover plate can come to rest.

For mounting the grip portion at the pressure member, the radial openings within the ring element are open toward the cover plate and, after completed mounting of the grip at the pressure member, are covered by the cover plate. As a securing means against accidental rotation of the grip together with the pressure member about the longitudinal



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axis of the closing device, the cover plate is preferably provided within the area congruent to the radial openings with substantially radially extending cutouts the width of which corresponds substantially to half of the width of the radial openings for receiving the pegs provided within the ring element. In this manner, the longitudinal edges of the cutouts in the cover plate provide abutments for the peg-shaped projections of the C-shaped bracket forming the grip. Only when the grip is axially pressed by the operator against the tank closure, the edges serving as abutments at the cover plate are overcome and a rotation of the grip with the pressure member about the longitudinal axis of the tank closure is possible.

In order to secure the grip portion in its rest position so that it cannot be accidentally moved into the actuating position during operation of the working tool, it is expedient to provide between the pressure member and the grip a locking means so that the grip is secured in the rest position. This locking means will preferably include elastic tongues at the pressure member provided with locking projections and recesses provided at the peripheral edge of the free ends of the grip.

Since the tank closure is especially designed for portable working tools, its design should take into consideration also weight reduction, the use of light-weight materials etc. as well as an optimal selection of materials. For example, the grip may be provided at its side facing the clamping members with recesses, while the upper side of the grip may have a uniform contour with the pressure member. For improving manipulation for pivoting the grip from its rest position into the actuating position, it is advantageous to provide the grip with a depression at its outer edge so as to provide a gripping edge.

Depending on the design of the curved paths, at the second clamping member the respective ends of the curved path may be provided with abutments for the cams so that the angle of rotation of the pressure member relative to the second clamping member is defined. Radially external to the curved paths a projection may be formed at the side of the disk of the second clamping member facing the grip which projection can be inserted into a predetermined recess at the grip so as to ensure that the grip can be pivoted into the rest position only when the cam of the pressure member is positioned at a certain location of the curved path. At the same time, an accidental pivoting into the actuating position is prevented. In the expanded state of the sealing ring, it rests under pressure at the surfaces of the clamping members and at a wall surface that delimits the fill opening. The wall surface that delimits the fill opening is preferably of a frusto-conical design so that additionally a securing in the axial direction is provided. The sealing ring is preferably an O-ring.

#### BRIEF DESCRIPTION OF THE DRAWINGS

The object and advantages of the present invention will appear more clearly from the following specification in conjunction with the accompanying drawings, in which:

FIG. 1 is an axial section of a tank closure positioned in the fill opening of a fuel tank;

FIG. 2 shows a plan view of the tank closure of FIG. 1;

FIG. 3 shows a first clamping member as an individual part;

FIG. 4 shows a view in the direction of arrow IV of FIG. 3;

FIG. 5 shows a section along the line V—V of FIG. 4;

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FIG. 6 shows a plan view of a second clamping member;

FIG. 7 shows a section along the line VII—VII of FIG. 6;

FIG. 8 shows a developed projection of a curved path; FIG.

9 shows a pressure member as an individual part; FIG. 10

shows a view in the direction of arrow X in FIG. 9; FIG. 11

shows a rear view of the pressure member of FIG. 9;

FIG. 12 shows a section along the line XII—XII of FIG.

11;

FIG. 13 shows a section along the line XIII—XIII of FIG.

11;

FIG. 14 shows a section along the line XIV—XIV of FIG.

11;

FIG. 15 shows a plan view of a grip as an individual part;

FIG. 16 shows a rear view of the grip of FIG. 15;

FIG. 17 shows a section along the line XVII—XVII of

FIG. 16;

FIG. 18 is a section along the line XVIII—XVIII of FIG.

16;

FIG. 19 is a plan view of a securing element as an individual part;

FIG. 20 is a rear view of the securing element of FIG. 19;

FIG. 21 is a section along the line XXI—XXI of FIG. 19;

FIG. 22 shows a section along the line XXII—XXII of

FIG. 20;

FIG. 23 shows a plan view of the fill opening without tank closure;

FIG. 24 shows a variation of the embodiment of FIG. 1;

FIG. 25 shows a variation of the embodiment of FIG. 24;

FIG. 26 shows a plan view of a fill opening with the tank closure removed.

#### DESCRIPTION OF THE PREFERRED EMBODIMENTS

The present invention will now be described in detail with the aid of several specific embodiments utilizing FIGS. 1–26.

FIG. 1 shows an axial section of a tank closure whereby the closing device 1 is positioned in the fill opening 3 of a fuel tank 2. The fuel tank 2 is provided with an annular bead 15 surrounding the fill opening 3 whereby at the inner side of the tank at the fill opening 3 a frusto-conical surface 16 is formed. The closing device 1 comprises substantially a first clamping member 5, a second clamping member 6, a grip 4, and a pressure member 30. The clamping members 5 and 6 can be axially displaced toward one another whereby the first clamping member 5 comprises a first clamping surface 7 and the second clamping member comprises a second clamping surface 8. These clamping surfaces 7 and 8 extend at an angle relative to one another and delimit an annular chamber 9. In this annular chamber 9 an elastic sealing ring 10 is positioned which rests under pressure at the clamping surfaces 7 and 8 as well as at the wall surface 16 of the fill opening 3. The sealing ring 10, according to the representation of FIG. 1, is preferably an O-ring.

The first clamping member 5 is in the form of disk or plate 11 which has a conical mantle surface providing the first clamping surface 7. The second clamping member 6 is a ring 12 having an end face that delimits the annular chamber 9 and provides the second clamping surface 8. The ring 12 and the disk or plate 11 have the same outer diameter whereby the respective outer diameter corresponds to the inner diameter of the fill opening 3 and has only such an amount of minimal play relative thereto that is needed to allow easy

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axial insertion, respectively, removal of the closing device 1 into and out of the fill opening 3 of the fuel tank 2. At the disk 11 of the first clamping member 5 a pin 20 is provided which extends coaxially to the longitudinal axis L of the closing device 1. The ring 12 that serves as a second clamping member 6 has unitarily connected thereto a disk member 22 which is provided with a central opening 23. The cross-section of this central opening 23 corresponds to the cross-section of the pin 20 so that the second clamping member 6 can be axially displaceably guided on the pin 20. At the end face of the ring 12 facing the second clamping surface 8 a radial flange 13 is provided with which the second clamping member 6 rests at the edge 14 surrounding the fill opening 3. The flange 13 comprises a depression 17 which is engaged by a projection 18 provided at the edge 14.

Above the second clamping member 6 a grip 4 as well as a pressure member 30 are provided. The grip 4 is fastened in a manner to be explained in the following to the pressure member 30 which, in turn, is supported with a ring element 29 on the pin 20. For fixing the components that are movable relative to the first clamping member 5 on the pin 20, a securing element 31 is provided which comprises a locking member 28 which engages a cutout 26 at the pin 20. The securing element 31 comprises furthermore a cover plate 27 which projects past the upper end of the pin 20 and extends into a depression of the pressure member 30 so that it cannot slip off the pin 20. The underside of the disk 11 is provided with a holder 21 for a securing element 19 so that the closing device 1 removed from the fill opening 3 will not be lost.

FIG. 1 shows the closing device 1 in the clamped position, i.e., the first clamping member 5 and the second clamping member 6 are axially displaced toward one another to such an extent that the annular chamber 9 is reduced in size and the sealing ring 10 is pressed by elastic expansion against the frusto-conical surface 16 of the fill opening 3. For opening the fuel tank, the grip 4 is pivoted about an axis of rotation extending at a right angle to the longitudinal axis L of the closing device 1 and the grip 4 together with the pressure member 30 is rotated about the longitudinal axis L so that the first and second clamping members 5, 6 are moved away from one another. Thus, the distance between the clamping surfaces 7 and 8 is again increased so that the size of the annular chamber 9 is also increased. The elastic sealing ring 10 thus radially contracts so that its outer diameter is less than the outer diameter of the disk 11, respectively, the ring 12. Thus, the closing device 1 can be removed from the fill opening 3 of the fuel tank 2.

The fuel tank 2 is conventionally produced from plastic material, however, it can also be produced of metal. The clamping members 5, 6, the grip 4, the pressure member 3, and the securing element 31 are preferably made of plastic material, for example, polyacetal (POM).

FIG. 2 shows a plan view of the tank closure in FIG. 1. The circular shape of the tank closure is provided by the grip 4, the pressure member 30, and the securing element 31. The cover plate 27 of the securing element 31 is substantially of a circular shape, which in the direction toward the grip 4, is provided with a chord. The grip 4 is a C-shaped bracket 32 the inner contour of which matches the shape of the cover plate 27. The bracket 32 with its free ends 33 is supported on the pressure member 40 the upper side of which has the shape of a ring segment so that the grip 4 and the pressure member 40 together form a ring surrounding the securing element 31. The grip 4, at the middle of the bracket 32, is provided with a recess 34 at its edge which is partially covered by the grip edge 35 at the upper side of the grip 4. This recess 34 and the grip edge 35 facilitate actuation of the

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grip portion 4 in order to bring it from its rest position into the actuation position.

FIG. 3 shows the first clamping member 5 as an individual part. The disk 11 comprises an outer edge with the first clamping surface 7 which is positioned at an angle of approximately 45° to the underside 11' of the disk 11. At the central part of the disk 11 the upwardly extending pin 20 is provided which at its top end 20' is provided with tangential recesses 26 positioned at a right angle to the longitudinal axis of the pin 20.

As can be seen especially clearly in FIG. 4, two parallel extending tangential recesses 26 are provided which at one end are connected by an arc 26'. The pin 20 comprises a substantially circular cross-section whereby a chord 25 intersects this circular shape. At the chord 25 a spring 70 is arranged which extends parallel to the longitudinal direction of the pin 20. This embodiment serves to secure the second clamping member 6 relative to the first clamping member 5 such that they cannot be rotated relative to one another. For this purpose, the opening 23 provided within the disk member 22 is also provided with a chord and with a groove that extends parallel to the longitudinal direction of the pin, as will be explained in the following in more detail. FIG. 5 shows a section along the line V—V of FIG. 4 from which the tangential recesses 26 become especially apparent.

FIG. 6 shows a plan view of the second clamping member 6 showing especially the opening 23 provided within the disk member 22. This opening 23 is substantially circular and has also a chord 24 like the pin 20 of the first clamp member 5 so that the cross-sections of pin 20 and opening 23 match one another. At the chord 24 a groove 71 is provided that engages the spring 70 provided at the pin 20. In this manner an exact axial guiding of the two clamping members 5, 6 is ensured, and the chords of the circular shape as well as the tongue-groove-arrangement provide for a rotational securing of the two clamping members 5, 6. At the upper side three curved paths 36, 36', 36'' extend on a circular arc about the opening 23 and are spaced relative to one another by 120°. The course of the curved path 36 and its arrangement on the disk member 22 is especially clearly shown in FIG. 7 showing a section along the line VII—VII of FIG. 6. The curved paths 36, 36', 36'' are identically shaped and comprise a lower depression a as well as a neighboring incline b, an upper dead center c, and an upper depression d. FIG. 6 shows that the depression may be an arc-shaped recess 17'.

A cam, riding on the curved path and connected to the pressure member represented in FIG. 1, thus ensures that upon rotation of the pressure member relative to the second clamping member 6 the pressure member is moved away from the disk member 22 of the second clamping member 6 or is moved toward it. The difference in levels between the lower depression a and the upper depression d may be, for example, 2 mm to 2.5 mm. The upper dead center c provides that the cam positioned within the upper depression d cannot be accidentally removed from this depression—the dead center c must first be overcome by a corresponding force. The curved path 36 is delimited by an abutment 37 at the lower depression a and an abutment 38 at the upper depression d. FIG. 6 shows that the depression may be an arc-shaped recess 17'.

The developed projection of the curved path 36 is represented in FIG. 8. It can be seen that the angular displacement of the respective curved path is 120°. Beginning at the abutment 37, there is first provided the lower depression a from where the upwardly extending incline b projects to the upper dead center point c. This upper dead center point c is

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in the form of a knob having a transition into the upper depression d which is delimited by further abutment 48. The angular range of movement of the cam between the two end positions in the lower depression a and the upper depression d is preferably in the shown embodiment of FIG. 8 approximately 82°. Radially externally to the curved path 36", according to FIGS. 6 and 7, at the side of the disk member 22 facing the grip 4 a projection 39 in the form of a pin is provided which projects clearly past the upper depression d and the abutment 38 limiting this depression.

FIG. 9 shows pressure member 30 as an individual part in a view from the top. This view shows clearly that the pressure member 30 is comprised substantially of a ring segment 40 and a ring element 29 formed thereat. The ring segment 40 extends over an angular distance of less than 180° so that the ring element 29 can be provided with two radial openings 48 that extend radially relative to the ring element 29 and are positioned diametrically opposite one another. From the representation of FIG. 10 which is a view in the direction of arrow 10 of FIG. 9, it is clearly apparent that the external shape of the ring segment 40 does not cover the radial openings 48. Instead, they are unobstructed in the radial direction.

The ring segment 40 thus is comprised according to FIG. 10 of an exterior wall 45 and an upper side 44 so that the ring segment 40 has a closed mantle surface and a closed upper side. As can be seen especially in FIG. 11, showing a rear view of the pressure member 30 of FIG. 9, it is apparent that the exterior wall 45 is supported with a plurality of stays 46 at the ring element 29 so that between the stays 46 hollow spaces 47 are provided that are delimited by the external wall 45 and the upper side 44. At the free ends of the ring segment 40 a lock 43 is provided which will be explained in more detail in the following in conjunction with the grip.

At the underside of the ring element 29 cams 42, 42', 42" are arranged which according to the representation of FIGS. 10 and 13 extend in the direction toward the second clamping member and in the representation according to FIG. 11 are spaced relative to one another by 120°. FIG. 13 shows that the upper side 44 of the pressure member 30 is provided with a cutout 49 which, as disclosed in connection with FIG. 1, serves to receive the cover plate 27 of the securing element. The section along the line XXII—XXII of FIG. 11, as shown in FIG. 12, shows the shape of the exterior wall 45 of the upper side 44 and of the ring element 29 as well as the hollow spaces 47 positioned therebetween. The ring element 29 is provided with a central opening 41 that serves to support the pressure member 30 on the pin 20 provided at the first clamping member. For this purpose, the underside of the ring element 29 as provided with the cutout 50 that extends at a right angle to the longitudinal axis and which is provided for mounting the securing element. FIG. 14 shows a section along XIV—XIV of FIG. 11. It is shown here that an elastic tongue 51 is formed at the stay 46 which extends first parallel to the stay 46 and then is curved outwardly. At the outer end of the elastic tongue 51 a locking projection 52 is provided.

FIG. 15 shows a plan view of the C-shaped bracket 32 that forms the grip 4. At the free ends 33 of the bracket 32 radially inwardly extending pegs 53 are arranged that engage the radial openings 48 of the ring element 29 (compare FIGS. 9 and 10). Due to the stiffness of the bracket 32, the pegs 53 are inserted from above into the radial openings 48 of the pressure member 30.

FIG. 16 shows a rearview of the grip 4 that has at the middle of the bracket 32 the recess 34 at the edge covered

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by the grip edge 35. The grip 4 is substantially comprised of an exterior wall 54, an inner wall 55, and a connecting upper side extending between the two. Between the outer wall 54 and the inner wall 55 the grip 4 is hollow. The required stiffness is provided by having stays 57 that extend between the exterior wall 54 and the inner wall 55. Between the stays 57 hollow spaces 58 are provided so that the grip portion 4, despite its great stiffness, has only a minimal weight. A hollow space 58' is positioned adjacent to the recess 34 and is designed such that it is suitable for receiving the projection 39 at the upper side of the disk member 22 (see FIG. 7) while the other hollow spaces 58 are of such a size that the projection 39 cannot enter. Thus, the grip 4 can only be pivoted into the rest position when the pressure member 30 is in a position in which the closing device is completely and correctly introduced into the fill opening.

FIG. 17 shows a section along the line XVII—XVII of FIG. 16. It can be taken from this drawing that the exterior wall 54, the inner wall 55, and the upper side 56 form a hollow body that is open at its underside. The pin-shaped projections (pegs) 53 are formed as a unitary part of the grip 4.

FIG. 18 shows a section along the line XVIII—XVIII of FIG. 16. This section extends through the recess 34 and through the grip edge 35, i.e., through the area in which the bracket 32 has its minimum cross-section. Furthermore, it can be seen that the free ends 33 have an arc-shaped mantle surface 59. At one end of the arc shape a groove 60 is provided that extends parallel to the pivot axis of the grip 4. When the grip 4 is mounted on the pressure member 30, the locking projection 52 of the elastic tongue 51 rests under prestress at the mantle surface 59 so that, upon reaching the rest position of the grip 4 on the closing device according to the representation of FIG. 1, the locking projection 52 engages the groove 60 and the grip 4 is secured in this position. FIG. 18 also shows that the mantle surface of the peg 53 of the grip 4 has an edge 61 that extends parallel to the axis of rotation of the grip 4.

FIGS. 19—22 show different views and sections of the securing element 31 that serves for fastening and securing the second clamping member 6, the pressure member 30, and the grip 4 on the pin 20. The cover plate 27, at the side that is facing the pivot bearing consisting of the radial openings 48 and the pegs 53, is provided with radially extending recesses 62 which are positioned in the area of the upwardly radially extending openings 48 when the securing element 31 is mounted on the pin 20. The sidewalls of the recesses 62 form abutments for the edge 61 of the pegs 53 so that an accidental rotation of the grip 4 about the longitudinal axis L of the closing device is prevented. Only when a corresponding pressure is exerted onto the grip 4 in the direction of the longitudinal axis L of the closing device, the grip 4 can be rotated together with the pressure member 30 on the pin 20. As can be seen in FIG. 20, the securing element 31 at the underside of the cover plate 27 is provided with a U-shaped locking member 28 having laterally and parallel extending legs 28' for engaging the tangential recesses 26 of the pin 20. As can be seen in FIG. 21, the legs 28' of the locking member 28 extend parallel to the cover plate 27 at a predetermined distance.

FIG. 23 shows a section of the fuel tank 2 with fill opening 3 in a view from the top. The annular bead 15 and the surface 16 are provided at the inner side of the fuel tank and are thus shown in dashed lines. A ring segment 18' is formed as a projection of the edge 14 surrounding the fill opening 3. The ring segment 18' extends over an angular distance of 180° and is designed to be received in the arc-shaped recess 17'



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of the flange 13 (see FIGS. 6 and 7). In this manner, it is ensured that the closing device 1 cannot be rotated relative to the fuel tank 2 but instead a large surface area support action and a defined mounting position are provided. The latter results in that the closing device 1 can be mounted only in one particular angular position so that the grip 4 relative to the working tool will assume a position ensuring safe handling of the device.

The assembly of the individual parts that form the closing device 1 is disclosed in the following. Onto the pin 20 of the first clamping member 5, after the opening 23 in the disk member 22 has been aligned such that the tongue-and-groove-arrangement coincides, the second clamping member 6 is slipped until the second clamping surface 8 of the ring 12 comes to rest at the first clamping surface 7 of the disk 11. Subsequently, the pressure member 30 with its ring element 29 is slipped onto the pin 20 so that the pressure member 30, relative to the second clamping member 6, is positioned in a rotated position in which the cam 42 is positioned in the lower depression a of the curved path 36. Now, the mounting of the grip 4 on the pressure member 30 takes place by introducing the bracket 32 with its free ends 33, respectively, its pegs 53 into the radial openings 48 at the ring element 29. Since the pressure member 30, due to the position of the cam on the curved path, has a position in which the grip 4 and the pressure member 30 are located closest to the disk 11, the cutouts 50 at the ring element 29 and the tangential recesses 26 at the pin 20 are congruent. When the grip 4 is flipped upward into the actuating position, the securing element 31 with its locking member 28 can be inserted into the tangential recess 26 whereby the parallel legs 28' engage the tangential sections 26' of the tangential recess 26. When the locking device 28 is completely inserted into the tangential recess 26, the pressure member 30 can be lifted again so that the ring element 29 is displaced axially across the locking element 28 of the securing element 31. In this manner, the securing element 31 is fixed on the pin 20. Since the cover plate 27 is positioned within the recess 49 of the pressure member 30, the pressure member 30 is secured on the pin 20. Now the sealing ring 10 is inserted across the edge of the disk 11 into the annular chamber 9 so that the second clamping member 6 is moved into the end position in which the annular chamber 9, due to the spacing between the clamping surfaces 7 and 8, has its greatest volume. Now the closing device 1 is ready for use.

FIG. 24 shows an axial section of a further embodiment of a tank closure in which the closing device 100 is positioned in a fill opening 103 of a fuel tank 102. The fill opening 103 is formed by an annulus 93 as an integral part of the fuel tank 102 whereby the annulus 93 has a step 92 at an end thereof positioned in the interior of the fuel tank. The step 92 is provided with axial projections 94 and radial cutouts 98. The fuel tank 102 is provided with an axially outwardly projecting annular collar 90 which surrounds the fill opening 103 in a circular manner whereby the inner contour of the annular collar 90 is inwardly curved and extends to a curved transition 91 to which is connected the annulus 93. The closing device 100 comprises substantially a first clamping member 105, a second clamping member 106, a grip 104, and a pressure member 130. The clamping members 105 and 106 are axially displaceable relative to one another whereby the first clamping member 105 includes a first clamping surface 107 and the second clamping element 106 comprises a second clamping surface 108. The clamping surfaces 107 and 108 extend at an angle relative to one another and delimit an annular chamber 109. In this annular chamber 109 an elastic sealing ring 110 is

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positioned which is pressed against the clamping surfaces 107 and 108 as well as against the curved transition 91 of the fill opening 103. This sealing ring 110 is comprised of a mineral oil-resistant material and is advantageously an O-ring.

The first clamping member 105 is a disk 111 which has a radial surface that forms the first clamping surface 107. The second clamping member 106 is a disk 122 the conical contour of which delimiting the annular chamber 109 is the second clamping surface 108. Adjacent to the radially exterior end of the clamping surface 108, a radial flange 113 is positioned which extends into the vicinity of the collar 90. The disk 111 comprises a first axial section 95 the upper end face of which forms the first clamping surface 107. Adjacent to the first axial section 95 a second axial section 96 is provided which projects through the step 92 into the interior of the fuel tank. At the forward end of the second axial section 96 radial projections 97 are provided which engage radial cutouts 98. Since the step 92 is shaped as a ring segment, the axial projections 94 form together with the radial cutouts 98 as well as the radial projections 97 at the second axial section 96 a bayonet closure.

Relative to the first axial section 95, the fill opening 103 has only such minimal play as is required for axially introducing, respectively, removing the closing device 100 from the fill opening 103 of the fuel tank 102. At the disk 111 of the first clamping member 105 a pin 120 is formed which extends coaxially to the longitudinal axis L of the closing device 100. The disk 122 acting as a second clamping member 106 comprises a central opening 123 with which the second clamping member 106 is axially slidably guided on the pin 120. Above the second clamping member 106 a grip 104 and the pressure member 130 are arranged. The grip 104 is fastened to the pressure member 130 which, in turn, is supported with a ring element 129 on the pin 120. For securing the components that are movable relative to the first clamping member 105 on the pin 120, a securing element 131 is provided that includes a locking member 128 which engages a tangential recess 126 at the pin 120. The securing element 131 includes furthermore a cover plate 127 which extends across the upper end of the pin 120 and extends also into a depression of the pressure member 130 so that it cannot slip off the pin 120. The closing device 100 is shown in the clamped position, i.e., the first clamping member 105 and the second clamping member 106 are axially displaced relative to one another such that the annular chamber 109 is reduced in size so that in this manner the sealing ring 110 is pressed by elastic expansion against the curved transition 91 of the fill opening 103. Furthermore, due to the axial forces the radial outer projections 97 are pressed against the radial clamping surfaces of the axial projections 94 and the step 92. Optionally, at the projections 97 and the step 92, projections, respectively, cutouts can be provided that provide for a positive-locking engagement.

For opening the fuel tank, the grip 104 is pivoted about an axis of rotation that extends at a right angle to the longitudinal axis L of the closing device 100 and the grip 104 is then rotated together with the pressure member 130 about the longitudinal axis L so that the first and second clamping members 105, 106 are moved away from one another. Thus, the distance of the clamping surfaces 107 and 108 is increased so that the annular chamber 109 is also enlarged and the pressing action of the elastic sealing ring 110 against the curved transition 91 is canceled. In this manner, the radial outer projections 97 are also lifted off the clamping surfaces 107, 108 and the optionally present positive-locking connection is also disengaged so that, upon rotation

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of the closing device **100** about the longitudinal axis **L**, the bayonet-type closure is released so that the closing device **100** can be removed from the fill opening **103** of the fuel tank **102**.

FIG. 25 shows a variation of an embodiment of FIG. 24 which in most parts is identical to the aforescribed embodiment. For same elements the same reference numerals as in FIG. 24 are thus used. FIG. 26 shows a plan view of the fill opening **103** with the closing device removed. At the inner circumference the axial collar **90** is provided with a radially projecting portion **80** which extends only over an angular distance of approximately 25° and engages a corresponding radial recess of the disk member **122**.

The collar **90** is provided with a sleeve **85** extending in the axial direction which surrounds the pressure member **130** as well as the grip **104** in the radial direction. Only the upper edge of the pressure member **130**, the grip **104**, and the securing element **131** projects from the sleeve **85**. The fill opening **103** comprises at the lower end of its annulus **93** three ring segments **86** between which recesses **87** and **88** are arranged. The recess **87** extend over a smaller angular distance than the recesses **88** and the angular spacing between the recesses **87** and **88**, respectively, the two recesses **88** are not identical.

The present invention is, of course, in no way restricted to the specific disclosure of the specification and drawings, but also encompasses any modifications within the scope of the appended claims.

What we claim is:

1. A tank closure for a fill opening of a fuel tank, said tank closure comprising:
  - a closing device extending axially through a fill opening of a fuel tank;
  - said closing device comprising a grip for actuating said closing device;
  - said grip rotatable about a longitudinal axis of said closing device for closing and opening said tank closure;
  - said closing device comprising a first clamping member and a second clamping member;
  - said first and said second clamping members moveable axially toward one another;
  - said first clamping member having a first clamping surface and said second clamping member having a second clamping surface;
  - said first and second clamping surfaces facing one another and defining therebetween an annular chamber;
  - said first and second clamping surfaces positioned at an angle  $\alpha$  to one another;
  - said closing device further comprising a radially elastically expandable sealing ring positioned in said annular chamber;
  - wherein said first clamping member is a disk and wherein said second clamping member is positioned coaxially to said disk;
  - wherein said disk has a pin and said second clamping member has an opening;
  - wherein said pin is received in said opening and has a cross-section matching a contour of said opening so that said second clamping member is axially movably guided by said pin, but said disk and said second clamping member are prevented from rotating relative to one another.
2. A tank closure according to claim 1, wherein said sealing ring in a radially expanded position is pressed

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against said first and second clamping surfaces and against a wall surface defining said fill opening, wherein said wall surface is frusto-conical.

3. A tank closure according to claim 1, wherein:
  - said disk is a first disk and comprises at least one first axial section having an upper end face;
  - said upper end face is said first clamping surface;
  - said second clamping member is a second disk;
  - said second disk has a conical mantle surface; and
  - said conical mantle surface is said second clamping surface.
4. A tank closure according to claim 3, wherein said first clamping surface extends at a right angle to said longitudinal axis of said closing device.
5. A tank closure according to claim 1, wherein said disk has a frusto-conical mantle surface and wherein said frusto-conical mantle surface is said first clamping surface.
6. A tank closure according to claim 5, wherein:
  - said second clamping member comprises a ring positioned coaxially to said disk;
  - said ring has an end face; and
  - said end face is said second clamping surface.
7. A tank closure according to claim, 6, wherein said second clamping surface extends at a right angle to said longitudinal axis of said closing device.
8. A tank closure according to claim 6, wherein:
  - said ring comprises a unitary disk member and said opening is provided in said disk member.
9. A tank closure according to claim 8, wherein:
  - said cross-section and said contour have a circular-arc portion connected by a straight portion;
  - one of said straight portions has a projection extending parallel to a longitudinal axis of said closing device;
  - the other of said straight portions has a groove extending parallel to said longitudinal axis of said closing device.
10. A tank closure according to claim 1, wherein said closure device further comprises a pressure member for transmitting an actuating movement of said grip for actuating said tank closure into a relative axial movement of said first and second clamping members.
11. A tank closure according to claim 10, wherein:
  - said pressure member is supported on said pin so as to be rotatable about said longitudinal axis of said closing device;
  - said closing device comprising at least one control path extending as a circular arc about said longitudinal axis; and
  - said pressure member cooperating with said at least one control path.
12. A tank closure according to claim 10, wherein:
  - said disk has a frusto-conical mantle surface and said frusto-conical mantle surface is said first clamping surface;
  - said pressure member is supported on said pin so as to be rotatable about said longitudinal axis of said closing device;
  - said closing device comprising at least one control path extending as a circular arc about said longitudinal axis; and
  - said pressure member cooperating with said at least one control path.
13. A tank closure according to claim 12, wherein:
  - said second clamping element comprises a ring positioned coaxially to said disk;

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said pressure member comprises a ring segment including a centrally arranged ring element;  
 said ring element having an inner diameter matching an outer diameter of said pin;  
 said ring element having at least one cam connected to a surface facing said ring;  
 said ring including a surface provided with said at least one control path; and  
 said at least one cam cooperating with said at least one control path.

14. A tank closure according to claim 13, including three of said cams and three of said control paths, wherein said three cams are spaced at an angular distance of 120° relative to one another and wherein said three control paths are spaced at an angular distance of 120° relative to one another, wherein a control stroke of each one of said three control paths extends over an angular distance of 80°.

15. A tank closure according to claim 13, wherein said ring segment has an axial height greater than an axial height of said ring element and wherein a top surface of said ring segment projects upwardly past an upper end of said pin.

16. A tank closure according to claim 10, wherein said grip is a C-shaped bracket having free ends, wherein said free ends are pivotably connected to said pressure member, and wherein a pivoting range of said grip from a rest position into an actuating position is 90°.

17. A tank closure according to claim 16, wherein each one of said free ends has a radially inwardly extending peg and wherein said ring element has matching radial openings for receiving said pegs.

18. A tank closure according to claim 17, further comprising a securing element connected to said pin, wherein:

said grip in said actuating position engages across said securing element and is rotatable together with said pressure member about said longitudinal axis of said closure device;

said securing element comprises a cover plate and a U-shaped locking member connected to said cover plate so as to extend parallel to said cover plate;  
 said U-shaped locking member comprises parallel legs;  
 said pin having tangential recesses; and  
 said parallel legs engaging said tangential recesses.

19. A tank closure according to claim 18, wherein said radial openings open toward said cover plate and wherein said cover plate, in areas congruent with said radial openings, has radially extending cutouts having a width of one half a width of said radial openings.

20. A tank closure according to claim 19, wherein:

said pressure member comprising elastic tongues with locking projections;

said free ends of said C-shaped bracket having recesses for receiving said locking projections for securing said grip in said rest position at said pressure member;

said pegs have an edge extending parallel to an axis of rotation of said grip;

said edges, in said actuating position of said grip, are in abutment with a sidewall of said cutouts.

21. A tank closure for a fuel tank, said tank closure comprising:

a fill opening provided at a fuel tank;

a closing device extending axially through said fill opening;

said closing device comprising a grip for actuating said closing device;

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said grip rotatable about a longitudinal axis of said closing device for closing and opening said tank closure;

said closing device comprising a first clamping member and a second clamping member;

said first and said second clamping members moveable axially toward one another;

said first clamping member having a first clamping surface and said second clamping member having a second clamping surface;

said first and second clamping surfaces facing one another and defining therebetween an annular chamber;

said first and second clamping surfaces positioned at an angle  $\alpha$  to one another;

said closing device further comprising a radially elastically expandable sealing ring positioned in said annular chamber;

wherein said first clamping member is a disk and wherein said second clamping member is positioned coaxially to said disk;

wherein said disk has a pin and said second clamping member has an opening;

wherein said pin is received in said opening and has a cross-section matching a contour of said opening so that said second clamping member is axially movably guided by said pin, but said disk and said second clamping member are prevented from rotating relative to one another;

wherein said fill opening has an annulus extending into an interior of the fuel tank, wherein an end of said annulus in the interior of the fuel tank has a radially inwardly extending step.

22. A tank closure to claim 21, wherein the fuel tank has an axially outwardly projecting annular collar surrounding said fill opening, wherein said annular collar has an inwardly curved inner wall and wherein said inner wall has a carved transition into an inner wall of said annulus.

23. A tank closure according to claim 21, wherein:

said inner wall of said annular collar has at least one inner radial projection;

said second disk has a radial recess; and

said inner radial projection engages said radial recess.

24. A tank closure according to claim 21, wherein said closure device further comprises a pressure member for transmitting an actuating movement of said grip for actuating said tank closure into a relative axial movement of said first and second clamping members.

25. A tank closure according to claim 24, further comprising an axially outwardly projecting annular collar provided at the fuel tank and surrounding said fill opening and a sleeve connected to said annular collar, wherein said sleeve radially surrounds said pressure member and said grip.

26. A tank closure according to claim 21, wherein said first disk comprises a second axial section extending coaxially through said radially inwardly extending step and positive-lockingly secured thereat.

27. A tank closure according to claim 26, wherein:

said radially inwardly extending step has at least two ring segments and recesses interposed between said ring segments;

said radially inwardly extending step having cutouts at an end face thereof facing the interior of the fuel tank;

said second axial section comprises outer radial projections extending into said recesses interposed between said ring segments and engaging said cutouts.

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28. A tank closure according to claim 27, wherein three of said ring segments, three of said recesses, and three of said outer radial projections are provided and wherein at least one of said ring segments and one of said recesses extend over an angular distance different from an angular distance of the remaining ones of said ring segments and said recesses.

29. A tank closure according to claim 21, wherein said second clamping member comprises a ring positioned coaxially to said disk, said ring has an end face, and said end face is said second clamping surface.

30. A tank closure according to claim 29, wherein said disk has a first outer diameter and said ring has a second outer diameter and wherein said first and said second outer diameters have minimal play relative to a diameter of said fill opening so as to allow removal of said closing device from said fill opening.

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31. A tank closure according to claim 29, wherein said ring comprises a flange remote from said annular chamber and wherein said fill opening has a peripheral edge, wherein said flange rests at said peripheral edge of said fill opening.

32. A tank closure according to claim 31, wherein:  
said flange has at least one arc-shaped recess extending over an angular distance of up to 180°;  
said fill opening has an annular segment connected to said peripheral edge for engaging said arc-shaped recess;  
said annular segment extends over an annular distance identical to said angular distance of said arc-shaped recess.

\* \* \* \* \*

**EXHIBIT B**





US005320240A

**United States Patent** [19]

Wehle et al.

[11] Patent Number: **5,320,240**[45] Date of Patent: **Jun. 14, 1994**[54] **CLOSURE FOR A VESSEL**

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[73] Assignee: **Andreas Stihl, Waiblingen, Fed. Rep. of Germany**

[21] Appl. No.: **11,514**

[22] Filed: **Feb. 1, 1993**

[30] **Foreign Application Priority Data**

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[51] Int. Cl.: ..... **B65D 55/16; B65D 3/00**

[52] U.S. Cl.: ..... **220/375; 220/367**

[58] Field of Search ..... **220/375, 367, 360, 361, 220/205, 206**

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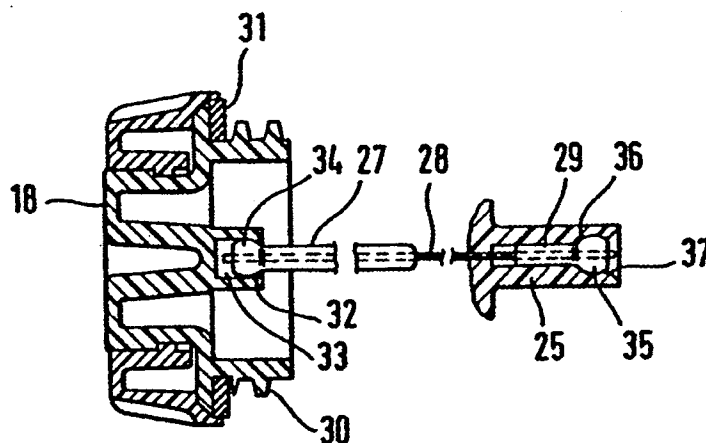
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[57] **ABSTRACT**

The invention is directed to a closure for a vessel such as a fuel tank or lubricant tank of a portable handheld work apparatus having an internal combustion engine. The closure includes a filling stub formed on the vessel and defining an opening and a cap for closing off the opening seal tight with respect to the ambient when the cap is placed on the filling stub. A holder prevents the cap from being separated from the vessel after the cap has been removed from the filling stub. The holder includes a flexible member having first and second end portions and an elongated flexible segment disposed between the end portions. A first attachment disposed on an inner wall surface of the cap fixedly holds the first end portion on the cap and a second attachment disposed on the vessel fixedly holds the second end portion on the vessel.

**13 Claims, 2 Drawing Sheets**

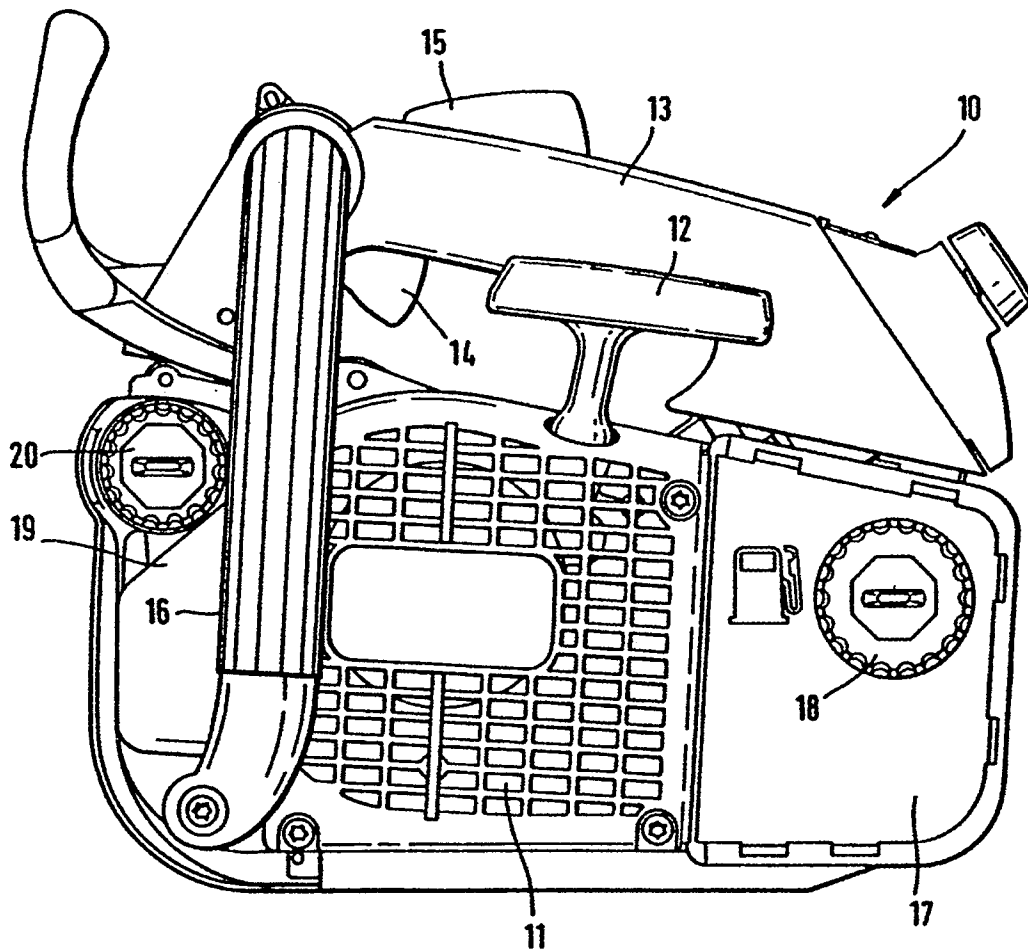
U.S. Patent

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Fig. 1

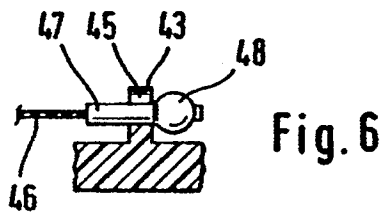
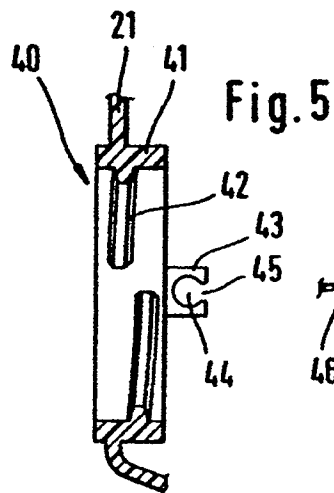
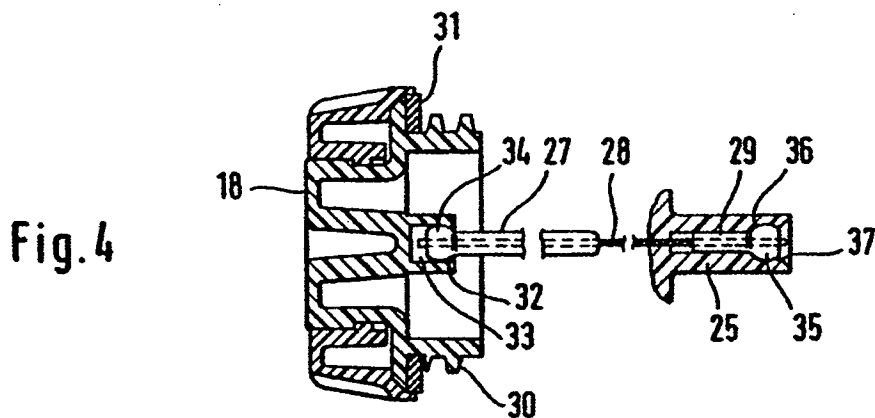
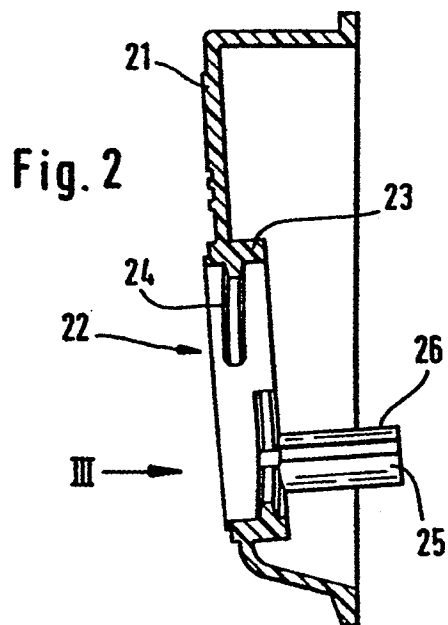
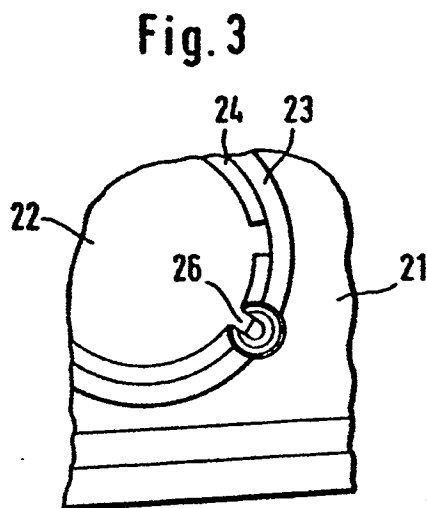


U.S. Patent

June 14, 1994

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## CLOSURE FOR A VESSEL

### FIELD OF THE INVENTION

The invention relates to a closure for a vessel for holding liquids such as a fuel tank or lubricant tank for a handheld portable work apparatus equipped with an internal combustion engine.

### BACKGROUND OF THE INVENTION

U.S. Pat. No. 4,705,190 discloses a closure for a tank wherein a cap is held on a holding unit made of plastic so that the cap cannot be lost when threadably disengaged from the tank. The holding unit comprises a ring-like portion at a first end which surrounds the cap. For this reason, the ring-like portion must be made correspondingly large and the second end of the holding unit is insertably held in a tube. A retainer in the form of a projection is provided at the second end of the holding unit and prevents the holding unit from slipping out of the tube. This holding unit for a tank closure is configured for motor vehicles and is complex to manufacture. In addition, the holding unit requires additional construction space for accommodating the insertable portion of the holding unit. A loop is formed laterally of the tank closure and would be most inconvenient in portable handheld tools when working, for example, in brush or the like.

### SUMMARY OF THE INVENTION

In view of the foregoing, it is an object of the invention to provide a closure for a tank wherein the cap is held so that it cannot be lost during filling of the tank. It is a further object of the invention to provide a closure for a tank wherein the holding unit can be manufactured in a simple manner and especially at low cost.

The closure of the invention is for a vessel such as a fuel tank or lubricant tank of a portable handheld work apparatus having an internal combustion engine. The closure includes: a filling stub formed on the vessel and defining an opening; a cap for closing off the opening seal tight with respect to the ambient when the cap is placed on the filling stub; the cap and the filling stub conjointly defining engaging means for receiving and securing the cap to the filling stub when the cap is mounted thereon; the cap having a wall surface which faces into the opening when the cap is mounted on the filling stub; holding means for preventing the cap from being separated from the vessel after the cap has been removed from the filling stub; the holding means including a flexible member having first and second end portions and an elongated flexible segment disposed between the end portions; first attachment means being disposed on the wall surface for fixedly holding the first end portion on the cap; and, second attachment means for fixedly holding the second end portion on the vessel.

The flexible member lies on the inner side of the vessel and is, for example, fixed on the inner edge of the filling stub. For this reason, the flexible member will lie above the edge of the filling stub when the cap is removed so that the entire cross section of the filling stub is open. Accordingly, no disturbing portions project into the region of the filling opening so that tanking can take place through a filling tube defining a filling nozzle. The tube can be inserted deep into the filling stub. The outer diameter of the filling tube to be introduced

can correspond approximately to the inner diameter of the filling stub.

An advantageous embodiment of the closure of the invention comprises providing the flexible member as a braided cord having respective ends with plastic molded thereon. A cord of this kind is greatly resistant to tearing while having a minimal material thickness and does not hinder in any way tanking of fuel because of its minimal material thickness. The injection-molded ends of plastic facilitate holding the flexible ends in the receptacles provided on the closure and filling stub, respectively. As an alternate embodiment, the flexible member can be a plastic band with the ends being configured so as to be stable with respect to form.

According to another feature of the invention, the ends preferably include a shank and a segment having an expanded diameter. These segments are held in a form-tight manner on the cap and on the filling stub, respectively, rearward of an opening having a reduced cross section. It is especially advantageous that the segment having the expanded diameter has at least in part a spherical surface. This configuration has the advantage that the end of the flexible member is journaled in the holder so as to be limitedly movable in all directions and has the further advantage that pushing the flexible member into a snap connection is facilitated.

A slit tube can be mounted on the filling stub for holding the flexible member thereto. The slit tube has a collar formed thereon directed inwardly. The tube has a slit so that the flexible member can be passed through the slit. The inwardly-directed collar defines the form-tight holder for the segment having the expanded diameter of the end of the flexible member.

As an embodiment alternative to the slit tube, a bore can be provided in a projection on the cap or on the filling stub. Furthermore, it is advantageous that both ends of the flexible member have the same form and that the attachment means at the filling stub and the cap have approximately the same configuration. This provides a universal application and facilitates assembly of the arrangement.

### BRIEF DESCRIPTION OF THE DRAWINGS

The invention will now be described with reference to the drawings wherein:

FIG. 1 is a side elevation view of a portion of a work apparatus equipped with an internal combustion engine and a fuel tank;

FIG. 2 is a detail view taken through a portion of the top wall of a fuel tank;

FIG. 3 is a detail view of a portion of the top wall shown in FIG. 2 viewed in the direction of arrow III;

FIG. 4 is a section through a cap and a holding element on the filling stub with the ends of the flexible member mounted therein;

FIG. 5 is an alternate embodiment of the attachment element on the filling stub; and,

FIG. 6 shows the attachment of an elastic member on a projection of the filling stub shown in FIG. 5.

### DESCRIPTION OF THE PREFERRED EMBODIMENTS OF THE INVENTION

FIG. 1 shows a portion of a handheld portable work apparatus 10 with this portion including an internal combustion engine 11 having a starter device 12, a handle 13 with levers 14 and 15 mounted therein and a handle 16 for holding and guiding the work apparatus 10 with the aid of the second hand. The internal com-

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bustion engine 11 is mounted adjacent to a fuel tank 17 which is provided with a cap 18. Furthermore, a vessel 19 is provided for a lubricant such as for oil for lubricating a saw chain. The cap 20 of the vessel 19 differs from that of the fuel tank 17 only with respect to size.

FIG. 2 is a section view taken through a top wall 21 of the fuel tank and includes a filling stub 22. This filling stub 22 is configured essentially in the form of a sleeve 23 and is provided with an internal thread 24. A plastic tube 25 is formed on the sleeve 23 and projects into the tank. The plastic tube 25 has a longitudinal slit 26 so that the tube opens toward the center axis of the sleeve 23.

FIG. 3 shows a detail portion of the top wall 21 and the filling stub 22. The tube 25 has a longitudinal slit 26 and is arranged in the region of the thread 24. The position of the longitudinal slit 26 is toward the axis of the sleeve 23 and facilitates insertion of the end of the flexible member.

FIG. 4 shows a section through the cap 18 with the end 27 of a braided cord 28 shown attached thereto. FIG. 4 also shows a section through the tube 25 in which the other end of the cord 28 is attached. The cap 18 is provided with a seal 31 and a thread 30 which corresponds to the internal thread 24 of the filling stub 22. A receptacle 33 is provided with latching means 32 and is arranged on the cap 18 on the side thereof directed toward the inside of the fuel tank 17. The receptacle 33 is provided for a segment 34 of the end 27 of the elastic member with the segment 34 being widened in diameter. This receptacle 33 is likewise made of plastic and is formed on the cap 18. The other end 29 of the braided cord 28 lies in the tube 25. For assembling this arrangement, the cord 28 is inserted through the slit 26 and then pulled in the direction toward the cap 18 whereby the end 29 moves into the tube 25 and an expanded segment 35 of the end 29 lies against a shoulder 36 in the tube 25. A projection 37 is provided in the tube 25 to ensure that the end 29 of the cord 28 can no longer slip back. The projection 37 and the expanded segment 35 conjointly define a snap connection.

FIG. 5 shows a section taken through a filling stub 40 which corresponds to the filling stub 22 shown in FIG. 2 and likewise has the form of a short sleeve 41 having an internal thread 42. A projection 43 is formed on the edge of the sleeve 41 facing toward the inner side of the top wall portion 21. The projection 43 has a bore 44 which communicates via a slit 45 with the outer edge of the projection 43.

In FIG. 6, the attachment of an elastic element 46 to the projection 43 is shown. One end 47 of the elastic element 46 is made of plastic stable with respect to form. The diameter of the end 47 is so dimensioned that an adequate clamping force is provided to prevent the end from slipping out. The end 47 is provided with a segment 48 having a widened diameter in order to take up pulling forces that occur when the cap is opened. For assembly, the elastic member 46 is passed through the slit 45 into the bore 44 and the end 47 is then axially pressed into the bore 44.

It is understood that the foregoing description is that of the preferred embodiments of the invention and that various changes and modifications may be made thereto without departing from the spirit and scope of the invention as defined in the appended claims.

What is claimed is:

1. A closure for a vessel such as a fuel tank or lubricant tank of a portable handheld work apparatus having

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an internal combustion engine, the tank defining an interior and the closure comprising:

a filling stub formed on said vessel and defining an opening;

said filling stub defining a central axis and having an inner end portion facing into said interior of said tank;

a cap for closing off said opening seal tight with respect to the ambient when said cap is placed on said filling stub;

said cap and said filling stub conjointly defining engaging means for receiving and securing said cap to said filling stub when said cap is mounted thereon; said cap having a wall surface which faces into said opening when said cap is mounted on said filling stub;

holding means for preventing said cap from being separated from the vessel after the cap has been removed from said filling stub;

said holding means including a flexible member having first and second end portions and an elongated flexible segment disposed between and interconnecting said end portions;

first attachment means being disposed on said wall surface for fixedly holding said first end portion on said cap;

second attachment means for fixedly holding said second end portion on said inner end portion of said filling stub;

each of said end portions including a first segment and a widened second segment having a diameter greater than said first segment;

said first and second attachment means including first and second structures, respectively;

said first and second structures being formed on said wall surface and on said inner end portion of said filling stub, respectively;

said structures defining respective holding means for receiving and firmly holding corresponding ones of the widened second segments;

each of said structures having an opening formed therein so as to communicate with said holding means;

said opening having a diameter less than said diameter of said widened second segment for accommodating the first segment; and,

said second structure having a longitudinal slit facing toward said central axis and said longitudinal slit being formed in said second structure so as to extend into the opening and the holding means of said second structure thereby permitting said flexible segment to be inserted therein when attaching said second end portion to said second attachment means.

2. The closure of claim 1, said elongated flexible segment being a braided cord and said end portions being defined by plastic molded on respective ends of said cord.

3. The closure of claim 1, said elongated flexible segment being a plastic band and said end portions likewise being plastic; and, said end portions being configured so as to be stable with respect to form.

4. The closure of claim 1, said widened segment having a surface which is at least a spherical surface in part.

5. The closure of claim 1, said second structure being a tube having a tube wall defining said holding means thereof; said longitudinal slit being formed in said tube wall and said tube wall defining an inner wall surface;



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and, a collar formed on said inner wall surface of said tube wall to define said opening.

6. The closure of claim 1, said first structure being a projection formed on said wall surface; said projection having two legs conjointly defining a bore for receiving said first segment of said first end portion therein; and, said legs having respective ends conjointly defining a slit communicating with said bore.

7. The closure of claim 1, said second structure being a projection formed on said filling stub; said projection having two legs defining a bore for receiving said first segment of said second end portion therein; and, said legs having receptive ends conjointly defining said longitudinal slit communicating with said bore.

8. The closure of claim 1, said first and second structures both having approximately the same configuration and said first and second end portions likewise both having approximately the same configuration.

9. The closure of claim 1, said stub and said vessel conjointly defining a single integral piece.

10. The closure of claim 9, said stub and said vessel conjointly defining a single integral piece.

11. A closure for a vessel such as a fuel tank or lubricant tank of a portable handheld work apparatus having an internal combustion engine, the tank defining an interior and the closure comprising:

a filling stub formed on said vessel as an annular wall defining an opening;

said annular wall defining a central axis and having an inner end portion facing into said interior of said tank;

a cap for closing off said opening seal tight with respect to the ambient when said cap is placed on said filling stub;

said cap and said filling stub conjointly defining engaging means for receiving and securing said cap to said filling stub when said cap is mounted thereon; said engaging means occupying a specific region within said opening of said filling stub;

said cap having a wall surface which faces into said opening when said cap is mounted on said filling stub;

holding means for preventing said cap from being separated from the vessel after the cap has been removed from said filling stub;

said holding means including a flexible member having a first and second end portions and an elongated flexible segment disposed between and interconnecting said end portions;

first attachment means being disposed on said wall surface for fixedly holding said first end portion on said cap;

second attachment means for fixedly holding said second end portion on said inner end portion of said annular wall;

each of said end portions including a first segment and a widened second segment having a diameter greater than said first segment;

said first and second attachment means including first and second structures, respectively;

said first and second structures being formed on said wall surface and on said inner end portion of said filling stub, respectively;

said structures defining respective holding means for receiving and firmly holding corresponding ones of the widened second segments;

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each of said structures having an opening formed therein so as to communicate with said holding means;

said opening of said structure having a diameter less than said diameter of said widened second segment for accommodating the first segment;

said second structure including a tube wall formed on said inner end portion so as to extend downwardly therefrom;

said tube wall having a longitudinal slit facing toward said central axis and said longitudinal slit being formed in said tube wall so as to extend into the opening of said second structure and said holding means of said second structure thereby permitting said flexible segment to be inserted therein when attaching said second end portion to said second attachment means; and,

said opening of said second structure opening within said region of said engaging means whereby said flexible segment does not extend beyond said engaging means when said cap is removed from said filling stub so as not to obstruct said opening of said filling stub.

12. A closure for a vessel such as a fuel tank or lubricant tank of a portable handheld work apparatus having an internal combustion engine, the tank defining an interior and the closure comprising:

a filling stub formed on said vessel and defining an opening;

said filling stub defining a central axis and having an inner end portion facing into said interior of said tank;

a cap for closing off said opening seal tight with respect to the ambient when said cap is placed on said filling stub;

said cap and said filling stub conjointly defining engaging means for receiving and securing said cap to said filling stub when said cap is mounted thereon; said cap having a wall surface which faces into said opening when said cap is mounted on said filling stub;

holding means for preventing said cap from being separated from the vessel after the cap has been removed from said filling stub;

said holding means including a flexible member having first and second end portions and an elongated flexible segment disposed between said end portions;

first attachment means being disposed on said wall surface for fixedly holding said first end portion on said cap;

second attachment means for fixedly holding said second end portion on said inner end of said filling stub;

each of said end portions including a first segment and a widened second segment having a diameter greater than said first segment;

said first and second attachment means including first and second structures, respectively;

said first and second structures being formed on said wall surface and on said inner end portion of said filling stub, respectively;

said structures defining respective holding means for holding corresponding ones of the widened second segments;

each of said structures having an opening formed therein for holding the first segment of the end portion;

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said opening having a diameter less than said diameter of said widened second segment for accommodating the first segment; and,  
the holding means of said second structure including a clip defining said opening thereof for gripping the first segment and said clip defining a slit adjacent said central axis and said slit being formed in said second structure so as to extend into the opening of

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said second structure thereby permitting said flexible segment to be inserted therein when attaching said second end portion to said second attachment means.

13. The closure of claim 12, said stub and said vessel conjointly defining a single integral piece.

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